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New Water Supply Works of Winnipeg[*]

By James H. Fuertes, Consulting Eng.

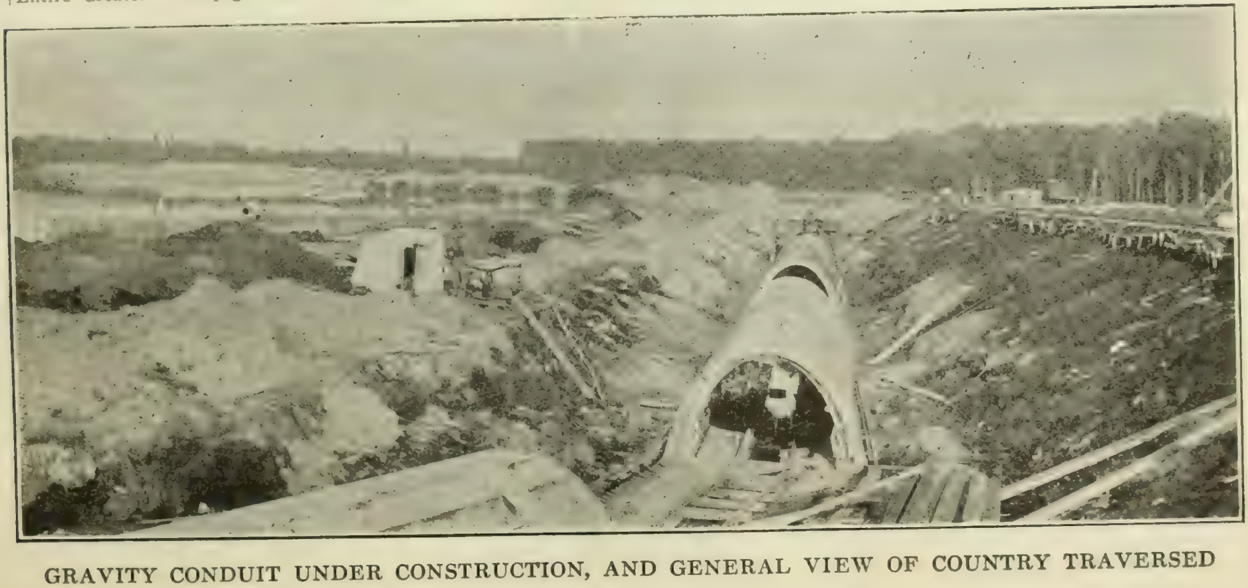
Brief history of Winnipeg Water Works. Description of new supply and of country traversed by the long concrete gravity aqueduct. Unusual intake conditions and special design thereby necessitated for intake.

Winnipeg is situated about 65 miles north of the international boundary, and about 35 miles south of the southern end of Lake Winnipeg, at the junction of the Red river, which rises in Minnesota and follows a northerly course, and the Assiniboine river joining it from the west, the combined waters continuing north to an outlet into Lake Winnipeg.

The city, prior to its organizaton as a town, was merely a small settlement or trading post, called Fort Garry, at the junction of these two rivers. In 1871 the population of Winnipeg is given as 1869; by 1890 it had jumped to 23,000; by 1910 to 132,720, and by 1913 to 215,000; the present population is estimated to be 250,000.[†]

The new water works of Winnipeg, forming the subject of this paper, were built to provide a satisfactorily large supply of soft water. Before the construction of these new works the city depended upon a ground water supply of very hard water, unfit, without softening, for manufacturing or commercial uses, and too limited in quantity even for domestic use. Under such conditions the establishment at Winnipeg of manufacturing or industrial works requiring a plentiful supply of suitable water was out of the question and a great handicap to the proper development of her otherwise excellent resources as a trade center. The question of changing the water supply had been agitated annually for a number of years, but the inevitable expense involved in going a great distance to secure a new supply necessitated the postponement of active steps in that direction a number of times.

Prior to 1880 the municipal water supply of Winnipeg was obtained from wells scattered about the town and distributed to the consumers from tanks and barrels on carts in the summer, or sleds in the winter. In 1882 the Winnipeg Water Works Company, operating under an exclusive twenty-year franchise, built a water works plant on the Assiniboine river on Armstrong point, establishing a pumping station and mechanical filter plant of the pressure type, the filtered water being pumped directly into the city's street mains. This system was purchased by the city in April, 1899, for a little over a quarter of a million dollars, but was abandoned in 1905 following the introduction of a ground water supply.



GRAVITY CONDUIT UNDER CONSTRUCTION, AND GENERAL VIEW OF COUNTRY TRAVERSED

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[*] Presented at the Montreal convention of the American Waterworks Association.

[†] Entire Greater Winnipeg Water District.

The quality of the water purveyed from the Assiniboine plant was not satisfactory, nor was the ground water supply, both being very hard. Agitation in favor of a new and better supply was kept up more or less continuously from that time until the commencement of the building of the present new supply.

In March, 1883, Dr. Agnew in a letter to the Free Press, directed attention to the Lake of the Woods as a source to which Winnipeg must ultimately look for her water supply, and again elaborated upon this source in February, 1884, in an address before the Manitoba Historical and Scientific Society. In February, 1895, Walter Moberley, C. E., made a report to the City Council advocating a new supply from the Winnipeg river. Nothing was done with either suggestion, however, and in October, 1896, Col. H. N. Ruttan, city engineer, reported on the relative merits of a supply from the Assiniboine river and a supply from artesian wells.

The well supply was developed quite extensively; the water, however, while agreeable to the taste and excellent as to appearance, was too hard for ordinary municipal purposes and in September, 1897, Rudolph Hering was asked to report upon the possibility of softening this water and on the merits of other available sources of supply. Mr. Hering examined and reported on a ground supply from Poplar Springs, a pumped supply from the Assiniboine river, a pumped supply from Winnipeg river, and on the extension and softening of the artesian well supply, recommending that the softened ground water supply be adopted and further developed.

About 1905, the city having been much depleted, so far as local sources were concerned, another examination was made and reported on to Councils in 1907 by Messrs. Fuertes, Lea, Schwitzer and Whipple, who investigated the possibilities of extending the ground water supply, securing a supply from the Red river and the Assiniboine river, as well as supplies from the Winnipeg river, and from the Lake of the Woods. This report favored developing a supply from Winnipeg river as being less expensive than a supply from the Lake of the Woods, while being equally satisfactory, after proper treatment.

Following this report another investigation was made by Prof. C. S. Schlichter for Public Utility Commissioner H. A. Robson, favoring a supply from the Lake of the Woods, or Shoal Lake.

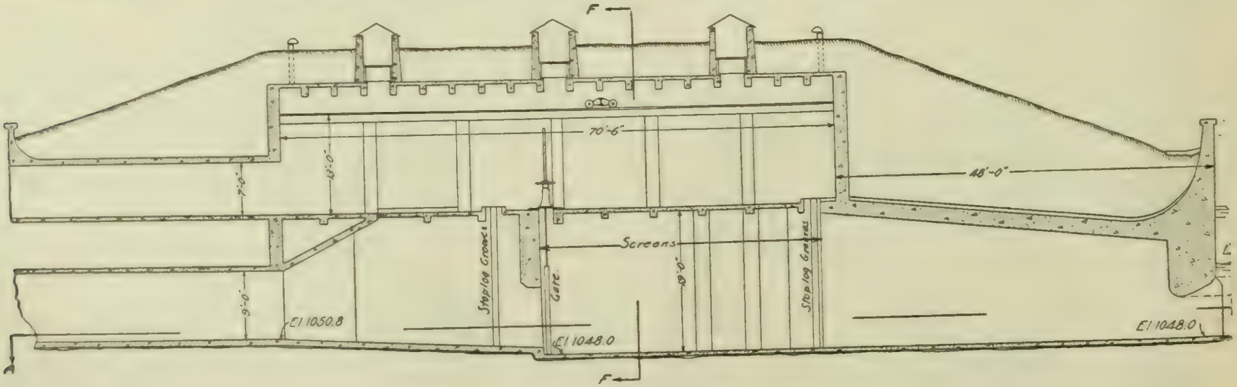
In the following year, 1913, the question of the desirability and availability of the Shoal Lake Supply was again referred to a commission of engineers, composed of Dr. Rudolph Hering, Frederick P. Stearns and James H. Fuertes, who, after considering the possibilities of a gravity supply to Winnipeg from the Lake of the Woods, through a concrete aqueduct, concluded that works could be built of much larger capacity than had heretofore been considered for a sum which would not be too difficult for the district to provide. The report was adopted by the officials of the Greater Winnipeg Water District on September 6, 1913. On the 20th of the same month five field parties were on the ground making the preliminary surveys for the alignment.

THE NEW SUPPLY

Organization: Since Shoal Lake waters are tributary to the waters of the Lake of the Woods, a portion of which crosses the international boundary into the United States, it was necessary to secure for the project the approval of the International Joint Commission having jurisdiction over boundary waters; and as the boundary line between the provinces of Manitoba and Ontario passed through Indian bay, a tributary of Shoal lake, it was necessary also to secure the consent of the Ontario government to the taking of these waters.

The Greater Winnipeg Water District was organized and constituted by proclamation of the lieutenant-governor of Manitoba June 10, 1913. The Water District was authorized to go outside of Manitoba for water by the Dominion Parliament in Act 3-4, George V., Chapter 208, and on October 2, 1913, an order in Council of the Province of Ontario was passed permitting the use of water for the Winnipeg Water District from Shoal Lake up to a limit of 100 million gallons per day. The International Joint Commission approved the application January 15, 1914.

All difficulties in regard to the securing of the water having been settled, surveys and investigations were immediately started and by the end of February, 1914, the location was completed, there having been involved the taking of 380 square miles of topography, 362 miles of transit lines, 1,317



SECTION B-B
See Figure 1

LONGITUDINAL SECTION OF INDIAN BAY INTAKE SHOWING OPERATING ROOM ABOVE SCREEN CHAMBER AND CONDUIT miles of levels, 95 miles of precise levels, 11,514 feet of soundings in Indian bay, and 3,897 feet of test borings along the line of aqueduct.

The work of clearing the right of way was started in March, 1914, and finished in about three months, the standard width of the right of way being 300 feet, greater widths were secured where necessary. The first actual construction work was the erection of the telephone line, 91 miles long, which was begun May 5, 1914, and cost about $32,500. In October, 1914, contracts were awarded for the whole aqueduct from Deacon to Shoal lake, and the first water was turned through the completed aqueduct and discharged into the McPhillips street reservoir in Winnipeg on March 26, 1919.

Following receipt of this report and its adoption by the city of Winnipeg and six other smaller neighboring municipalities which, with Winnipeg, had organized under the law of the Dominion and the provinces as "The Greater Winnipeg Water District" and the appointment of the commissioners, the engineers and the necessary staff prepared the way for actively prosecuting the establishment of the new supply.

COUNTRY TRAVERSED BY THE AQUEDUCT

It was found, from studies and inspection, that the line proposed in the Hering-Stearns-Fuertes report (which was based partly upon surveys made specially for this report and partly upon interpolated profiles based upon the profiles of the Canadian Pacific and Grand Trunk Railways) was a practicable line but that a more intimate knowledge of the country either side of this line gave promise of securing a more economical aqueduct than that following the line proposed.

Throughout the whole length of the line the country is very flat and was largely covered with swamps, timber and underbrush. Only in a few places was it possible to see off to any distance from the line, and actual elevations had to be taken along the section lines, or wherever clearings had been cut out, for a distance, sometimes, as much as ten miles either side of the line, in order to avoid running into impracticable country on the one hand, and in order to be able to pick out a better alignment on the other hand.

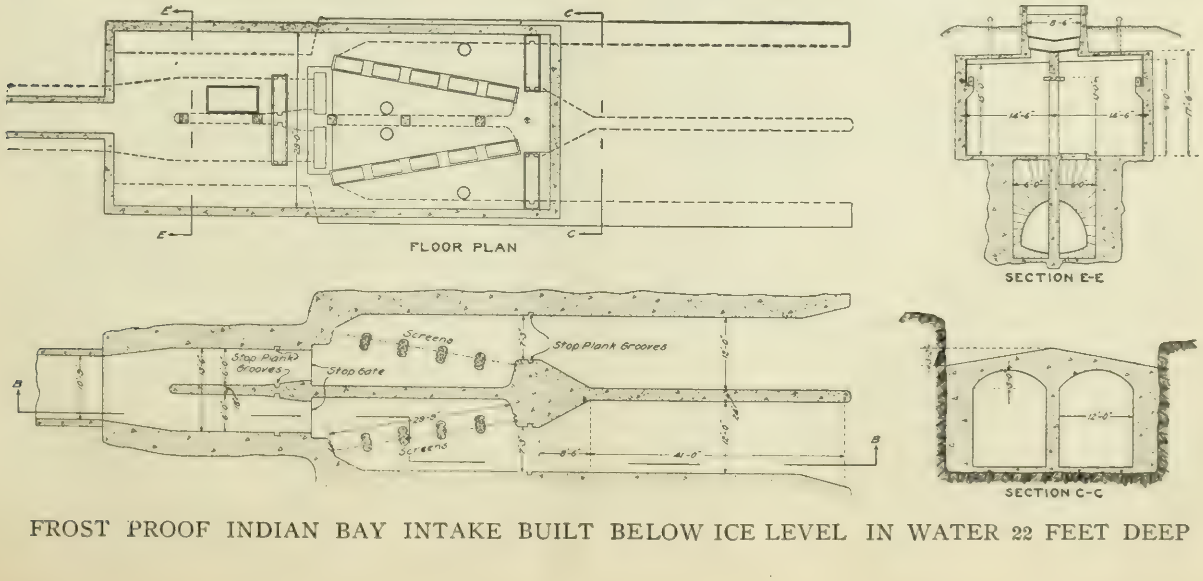
For about twenty miles eastward from Winnipeg the plains, formed by the deposition of clays from suspension in the sea water of the ancient glacial Lake Agassiz, have a slope of but one to three feet to the mile. To the eastward of this plain the country rises somewhat more rapidly for a few miles. Large deposits of gravel occur in ridges along what were, in ancient times, progressive shore lines of this inland sea as the continental ice-cap receded. Where the shore line followed along the contour of the ground, the glacial deposits were washed out, leaving the sand and gravel comparatively clean and free from clay. Going still further east and, in fact, located more or less along the whole length of the aqueduct, the soil is a mixture of clay, sand and gravel, sometimes stratified and sometimes mixed, on top of which has grown up successive generations of vegetation forming what are locally termed "muskegs."

The sub-soil throughout the whole distance is practically water-tight, and consequently the run-off of rain and melting snow, which amount together to only about 22 inches from the watershed in a year, is retarded so greatly that but three open streams are crossed by the aqueduct in the nearly 100 miles between Shoal lake and the Seine river, which joins Red river at Winnipeg.

SOURCE OF SUPPLY

The report of Hering, Stearns and Fuertes recommended securing the water from Indian bay, that portion of the Lake of the Woods nearest to Winnipeg. Indian bay is an arm of Shoal lake, and Shoal lake, which has a water area of 110 square miles, is connected with the main Lake of the Woods by means of a narrow channel called "Ash Rapids." While the watershed of Shoal Lake, 360 square miles, is not large enough to maintain in very dry years a yield of 85 million gallons a day, this yield can be had by drawing through it on the main body of water in the Lake of the Woods without appreciably affecting the water level of the main lake. The fluctuation in level between low and high water in Indian bay or Shoal lake lies between elevations 1059.6 and 1065.0 above sea level.

Indian bay, from which the water is taken, is



FLOOR PLAN

SECTION E-E

SECTION C-C

FROST PROOF INDIAN BAY INTAKE BUILT BELOW ICE LEVEL IN WATER 22 FEET DEEP about 6 miles long and from one to three miles wide. Numbers of soundings lengthwise and crosswise of this lake show its depth to vary from 24 to 26 feet over the whole bottom excepting in the immediate vicinity of the shores, which shoal up more or less rapidly.

At the western end of Indian bay a stream known as Falcon river enters and discharges highly colored water from swamps lying to the northwest of Indian bay. Just to the south of and parallel with Indian bay lies Snowshoe bay, a promontory varying from one-half a mile to a mile or more in width and with a length of about six miles separating Snowshoe bay from Indian bay. Both Snowshoe and Indian bays connect openly with Shoal lake at the eastern end of the promontory above mentioned.

DECOLORIZATION

The waters of all the bays tributary to Lake of the Woods are more or less highly colored, being fed by small streams having their origin in the swamps and muskegs bordering the main lake. The color of the water of Shoal lake and of the main Lake of the Woods, away from the influence of these small, highly colored streams and where time and the bleaching action of sunlight have had an opportunity to bring about discolorization, is not high enough to be objectionable for ordinary municipal uses. Indian bay, when first examined, was decidedly discolored throughout its whole area, the greater part of the discolorization coming from Falcon river.

A study of the topography of the promontory, lying between Snowshoe and Indian bays disclosed a low area through which a canal could be cut at small expense, to connect the two lakes; which suggested the plan, subsequently adopted, of diverting the black water of Snake Lake and Falcon river through this canal into Snowshoe bay by the building of a dyke across the shallow water at the west end of Indan bay.

The cost of this dyke and canal, which secured an intake point from which low colored water could be had in Indian bay, was about $147,000. To extend this aqueduct 5 miles further to Shoal lake, the only other alternative to secure satisfactory water, would have cost about $1,000,000.

The results have been quite satisfactory, as may be seen from the statement that on June 7, 1915 (the diversion dyke having been completed in 1914), the color of the water on the Falcon river site of the dyke across the end of Indian bay was 107, while the color on the Indian bay side of the dyke on the same day was 9 (platinum cobalt scale).

The natural color of the water in Indian bay is lower in the winter than in the summer; under the ice the color remains practically constant during the entire winter. During the winter of 1919-1920 the color at the intake remained at 12.

The bottom of Indian bay is more or less covered with accumulations of leaves, shells of infusoria, dead leaves, grasses and other matters of organic and mineral origin, generally reduced by time and natural agencies to a stable or non-putrescible condition. In addition the waters contain numbers of algae and living organisms of various kinds.

The lake being comparatively shallow, the waters experience two distinct turn-overs each year, due to the changes in temperature above and below the temperature of maximum density. Ice forms on the lake to a thickness of about 4 feet, and the temperature of the water drops to about 34 degrees at the bottom of the lake in very long-continued cold weather.

When water at the surface of the lake, on the approach of cold weather, reaches a temperature of 39 degrees, it tends to sink to the bottom of the lake and displace the warmer and lighter water underneath. This continues until the water of the entire lake has reached a graded temperature such that the heaviest remains at the bottom and the lightest at the top. In the following spring, when the surface water again warms up, the warmth being transmitted gradually to the lower strata, as soon as that at the surface reaches a temperature of 39 degrees it sinks, as before, displacing the colder water beneath, and a gradual readjustment of the entire mass takes place.

There are thus two distinct periods when bottom water will be brought to the surface and with each over-turning, of course, some of the matters which have settled to the bottom will be caught in the rising currents and brought up to the surface. This phenomenon is one which requires watching for many reasons, one of which was discovered during the first year of operation of the new works. On the occasion referred to such large quantities of grasses and weeds were brought up during the over-turn that the intake screens, before thought was given the matter by the local attendant, became clogged sufficiently to cause a head of several inches on the screens, with the consequent breaking out of the wire mesh, permitting dirty water and fish to pass into the aqueduct.

BASIS OF DESIGNS FOR WORKS

DESIGN OF INTAKE

The design of the lake intake was studied out with a view to preventing trouble that might interrupt the supply of water to the city. These troubles, it was anticipated, would be due largely to ice in the extremely cold winter weather. It was planned, therefore, to allow for an ice sheet 4 feet thick on the lake and to have a passage beneath this sufficiently wide and deep to admit the water into the intake with as little loss of head as possible and without drawing in spicules of ice forming on the under side of the ice sheet.

The general plan was to extend in front of the gate house two rock-ballasted earthen dykes with the side slopes of 1 on 3, in parallel lines cut from the shore 200 feet to where the water was about 22 feet deep at high water, the dykes being 180 feet apart on their center lines. The space between these dykes was dredged out and the whole area covered with screened gravel, bringing the finished surface up to elevation 1048, or about 13 feet below mean lake level.

The front wall of the concrete gate house was carried down to a depth of 8.7 feet below average lake level, or 6.25 feet below low water, in order to cut off the entrance of cold air into the screen chamber through the intake, and in order to prevent the formation of ice in the intake structure.

The screen chamber itself was simply an extension of the aqueduct with its bottom widened and its sides made vertical. This chamber was divided into two parts by a longitudinal partition, and two sets of screens were placed within in such a way as to offer a large area to the moving water and permit of removal for cleaning. The whole screen house was covered with an earth embankment four feet deep for frost-proofing, so that ice would not form on the fine mesh screens and retard the passage of the water.

Air temperatures as low as 50 degrees below zero are not infrequent at the intake and commonly temperatures of zero and lower prevail continuously from the beginning of December until the end of March. Frost, therefore, was a matter to be reckoned with in the design for these works. The general arrangement of the intake structure is shown in Figures 1 and 2.

The screens had a total submerged area at high water of about 700 square feet, which, for a water consumption of 100 million gallons per day, would correspond with 7 square feet per million gallons per day. The screens were of copper wire cloth, having ⅜-inch mesh backed by a screen with 1-inch meshes.

After the accident of the breaking through of the screens last summer, an additional set of vertical steel racks with 1½-inch spacing was installed just below the upper stop-log slot; a second set of screens with six meshes to the inch was also installed in connection with the coarser screen to guard against a possible reptition of that unfortunate and unpleasant experience. The three barriers have been successful in excluding undesirable water-borne life.

The screens are lifted for cleaning by a chain hoist running on overhead tracks. Inside of the screen house, but below the screens, there is a boat entrance to permit the dropping of a boat into the aqueduct for the purposes of inspection from the lake to the inverted siphon at the venturi meter under Falcon river. Another boat entrance is placed just beyond Falcon river to permit of inspection from Falcon river to Birch river, and again, at the beginning and end of each of the inverted siphons to the end of the arched section 5 miles east of Deacon.

The American Water Works Association Convention

Narrative of the fortieth annual convention of the Association, held at Montreal, Canada. Some slight changes were made in the constitution, a few new committees appointed and Cleveland selected for the next convention. The papers were read and discussed practically as provided by the program. The exhibit was an unusually attractive one.

About 450 members of the American Water Works Association, accompanied by an unusual number of ladies as guests, attended the fortieth annual convention of the American Water Works Association at Montreal during the week of June 21 to 26. Even the rainy weather which was continuous during the first two days of the week did not prevent the convention from being a most enjoyable one, and all of the members retained the spirit of optimism which was illustrated by Secretary Diven when he said (during the trip down the Lachine Rapids) that it was fortunate it was raining, because the glare of sun on the water would have prevented a good view of the rapids.

The exhibit was an unusually complete and attractive one, and the lay-out was such that not only did one have to pass through the exhibit hall to reach the convention hall, but until he had familiarized himself with the route he was likely to wander past most of the exhibits before he could find where the literary part of the convention was being staged.

There was just enough of the non-technical entertainment to relieve the long tedium of listening to and discussing papers, the diversions consisting of a trip through the rapids and a smoker. The ladies also were well taken care of, although the rain interfered to some extent with the program for their entertainment. In all respects the convention was very well planned and the plans carried out most effectively.

The program of the convention meeting was followed very nearly as planned and printed (with the customary exception that the sessions were all late in beginning). A few papers which had been scheduled were not present, and on the other hand, there were two or three which had come in after the program was made up. Superintendent's day gave opportunity for a series of general and very interesting discussions and formed a most enjoyable conclusion to the sessions of the convention. During the morning and afternoon discussions of this day in the main audience room, the Chemical and Bacteriological Section was holding sessions in an adjoining room, from which they emerged to join the main body of the society in watching a most interesting set of moving pictures showing the formation of frazil and anchor ice and listening to a paper on the subject of the formation and prevention of such ice.

In addition to the trip through the rapids and the smoker, many of the members found time for golf and some for a view of the city from an airplane. On Friday a number visited the Montreal Water Works plant in a specially conducted party, a few having visited the plant individually on previous days.

The business of the convention consisted in the selecting of members of the Nominating Committee from the several districts, the selection of the place for the next convention, and the adoption of amendments to the constitution. The first amendment had to do with the nominating of officers, the change being only in the detail that the Nominating Committee should be selected during the first day of the convention. This would permit the Nominating Committee to meet without the cost to the Society of their traveling expenses (amounting to about $500) in order to reach a common meeting place or the inconvenience to the members of the Nominating Committee required by attending such meeting. The amendment makes Article VI, Section 4, read as follows

"At the last order of business of the second session of the first day of the annual convention, the members of each district shall elect a member of the Nominating Committee to represent their respective districts. Due notice of such election shall be prominently given in the program of the convention (except in the year 1920) which shall be mailed to the members at least three weeks previous to the opening date of the convention. The votes of the districts shall be by ballot or acclaim, and a majority vote of the members of each district present and voting shall elect the member of the Nominating Committee to represent that district. The members of the Nominating Committee so elected, together with the last past president at the convention, who shall be chairman, shall constitute the nominating Committee to place in nomination candidates for the offices to be filled for the ensuing year."

Article VI, Section 5, was amended to read:

"The Nominating Committee shall hold a meeting at 8:30 A. M. on the second day of the convention; previous to which time suggestions of names to fill the various offices may be made by members of the association to the members of the Nominating Committee, or by leaving same with the secretary of the association prior to the meeting of the committee; names sent to the secretary by mail at any time prior to the meeting of the committee shall also be presented to the committee for consideration. Nominations shall be by majority vote of the Nominating Committee, who must place in nomination one, and may place two, candidates for each office to be filled. The nominations so named by the Nominating Committee shall be announced at the next session of the convention, and also be prominently posted in the convention hall, the secretary's office and the exhibit room of the convention."

After discussion of a proposal to change the method of presentation of making additional nominations by members of the association, this procedure was left as already provided for in the Constitution.

This method of selecting a Nominating Committee and having the nominations made and presented to the society was carried out at this convention. On Tuesday afternoon the several sections collected in groups in different parts of the hall and chose the following members of the Nominating Committee: First District, T. J. Lafreniére, of Montreal; Second District, George C. Andrews, of Buffalo; Third District, Herman Rosenstreter, of Newark; Fourth District, H. E. Keeler, of Chicago; Fifth District, E. L. Fulkerson, of Waco, Texas; Sixth District, Thomas Maloney, of Council Bluffs. On Thursday morning this committee presented its report, nominating as follows: for President, Dr. Edward Bartow; for Vice-president, W. S. Kramer; for Treasurer, Wm. W. Brush; for Trustee of the Third District, G. C. Bensheimer, and of the Sixth District, J. Chris. Jensen.

Officers for the year 1920-1921 were announced at the first session, the letter ballot having resulted in the election of Beekman C. Little as president, with 467 votes to 314 for M. L. Worrell; Edward Bartow for vice-president, with 448 votes to W. S. Kramer's 320 votes; James M. Caird for treasurer, with 416 votes to 351 votes for J. W. Ackerman; and the two trustees, Harry F. Huy and Robert J. Harding, for whose positions there was no contest.

The Convention Committee reported, recommending that the next convention be held at Cleveland, with Baltimore as second choice, invitations also having been extended from Kansas City. The members then balloted with the result that Cleveland received 87 votes, Kansas City 70 and Baltimore 49. Following the ordinary custom of eliminating all but the two highest, a second ballot resulted in the selection of Cleveland.

The Finance Committee reported a balance of cash in the bank of $1603, and $200 in bonds, together with a permanent investment fund having a par value of $12,000. Six hundred and sixty-seven dollars had been received in interest and $12,939 from dues and other income received through the secretary. The expenditures were kept within the budget allowance with the exception of two items, which, together, exceeded their allowance by $55. Considering the considerable increase in all costs during the year, this would seem to be a very creditable showing.

The expenditures were, however, greater than the income, and to avoid depleting the reserve, it seemed desirable to increase the dues of the society. The Executive Committee recommended that the dues of members be increased from $5 to $6, those of corporate members to $10, and associates to $15. Some members thought that the dues for active members should be increased to $7 rather than to $6. As the increase in dues requires a constitutional amendment, it was voted that the secretary send a questionnaire to the entire membership in order that the Executive Committe may be informed as to the opinions of the members on this point, in order that they may recommend the adoption next year of a constitutional amendment should such be generally approved by the members.

Another amendment to the constitution was suggested to the Executive Committee and reported without their approval, which would provide for the return of the society to the custom of electing the secretary rather than have him appointed by the Executive Committee. This was voted down, called up at a later session for consideration, and, after considerable discussion and some unfortunate clashes of opinion and charges against certain officials, was finally disposed of without any change being made in the Constitution in this respect.

PAPERS AND DISCUSSIONS

TUESDAY SESSION

At the opening of the sessions of the convention on Tuesday morning the president announced the appointment of Messrs. Liesen, Kramer and Wood as a committee on resolutions. He also announced the death during the year of Mr. Brown, who had served as stenographer at the conventions of the association for many years past and who was acquainted with most of the regular attendants at these conventions.

The president then read his annual address, suggesting that in the future this practice of requiring the president to deliver an annual address be dispensed with. The point given special prominence by President Davis was the importance of the "sections" of the association. He believed that the American Water Works Association should be truly representative of water works officials and matters in all sections of the country, and believed that this could be brought about only by having sections scattered throughout this entire area, sufficient to develop and crystallize local interests. Where there are now no sections, or the sections cover too large a territory, it may be possible to affiliate existing organizations with the association, or it may be preferable to organize new sections. This, he believes, would result not in a weakening of the central body, but in a strengthening of the ranks of the water works men through the central body and an increase in the benefits derived by them from the organization by means of the local sections. Mr. Davis also made a plea for much greater activity of this society in the development and promulgation of standards for the various supplies and methods employed by water works men. The society's standard specifications for cast iron pipe are now in general use and there would seem to be no reason why other standards might not prove equally successful and be accepted by both water works departments and manufacturers.

Following the president's address, the works of the Montreal Water and Power Company, which supplies a large part of the area of the city of Montreal which has been added in recent years to the original area of the old city, was described by F. H. Pitcher. Thomas W. Lesage then described the municipal water supply of the city, which supplies the old section and some parts of the more recent additions.

Following a two-hour recess for lunch, the water supply problems of the Province of Quebec were described by T. J. Lafreniére, sanitary engineer of the Province of Quebec. Mr. Lafreniére stated that Quebec has a law modeled more or less closely on the Bense Law of Ohio, but which has not had to withstand the legal attacks that have been encountered by the Ohio Board of Health. The Board of Health of the Province does not believe in compelling cities to treat sewage (presumably in case only that a nuisance is not created). Judging from their action in one important case, they will require water works corporations to purify the water supplied by them to the public in cases where such water was safe when their plants were built, but which has been rendered dangerous by later developments, only when the cities will reimburse the company for the expense of such purification either by permitting the rates to be increased or by paying the company outright for the construction of the purification plant.

James O. Meadows described Montreal's experience in the manufacture of alum. The method employed was practically the Hoover method used by cities in the United States. As good purification results were obtained with the alum secured by this Hoover method as by use of the more pure commercial product, and there was a saving of fully 50 per cent in the cost of alum purchased from private manufacturers.

The evening session opened with Beekman C. Little's paper entitled, "Water Works Experiences," in which the president-elect combined amusement, interest and instruction to the members present. Two papers illustrated by lantern slides were presented, one by Leonard A. Day entiled, "Economic Features of Pumping Station Operation"; the other by James B. Wilson entitled, "Difficulties in Building the Louisville Pumping Station." Mr. Day described in detail how the municipal pumping plants at St. Louis were enabled to save a very appreciable percentage of their coal consumption by modifications in the boiler plants, chiefly in the construction of the grate arches, etc.

Mr. Wilson described the difficulties encountered in sinking the foundations for the Louisville pumping station and the methods employed in overcoming them.

WEDNESDAY SESSION

Wednesday morning was occupied with a trip through the Rapids, which was taken by practically the entire attendance at the convention, and in the evening was the smoker given by the Water Works Manufacturers' Association, leaving only the afternoon for papers and discussions.

The first of these was a double paper on the new water supply of Winnipeg, a presentation of the conditions and the development of the plans being given by James H. Fuertes and a discussion of the construction by William G. Chase. Mr. Fuertes' portion of the discussoin is given in another part of this issue. Both of the papers were very interesting, describing a project costing more than $15,000,000, and were well illustrated with lantern slides.

Reports from the several sections were then called for and George C. Habermeyer reported for the Illinois Section, W. A. Judd for the Iowa Section and F. W. Cappelen for the Minnesota Section. All reported very encouraging activity and interest by the members of the several sections. During the convention the Canadian Section was organized, starting off with a very encouraging number of members, in view of which it was given the cup which is won each year by the section securing the largest percentage of increase in members. This cup had been held for three years in succession by the Minnesota Section, and according to the rules under which it had been given to the Society, could have been held by this section permanently; but in view of the fact that last year most of the sections lost members instead of gaining them on account of the war, the Minnesota Section, like good sports, yielded their claim to the permanent possession of the cup.

These reports were followed by the reports of the Finance Committee, which has already been referred to. The report of the Committee on electrolysis was presented by E. E. Minor. The committee recommended that the society endorse the practice of grounding secondaries of electric transformers to water pipes, because it would add greatly to safety from accidents due to electricity, while being in no way injurious to the water pipes. This was referred to the Executive Committee which, on Thursday morning, reported its approval of the suggestion. It was reported that Professor Ganz had stated that he knew of no objectionable results which had followed or were likely to follow from the practice and the Board of Fire Underwriters offered no objection thereto, and the approval of the society was therefore voted by the convention.

On motion of George A. Johnson, amended by John H. Gregory, it was voted to appoint a Committee on Standards, to cooperate with the American Standards Association, to prepare standards for bacterial analysis, coal, oil, chemicals, cement and other materials used by water departments, standards of purity for water for both domestic and industrial use, and standards for filtration plants and other parts of water works systems. This action was taken while the tellers were counting the ballots for the next place of meeting, the result of which has already been given.

(*To be continued*)

Delaware Highway Construction

At a conference held June 21, 1920, between chief engineer Charles M. Upham and chairman John G. Townsend of the Delaware State Highway Department, it was decided that it would be very inopportune to retard the procedure of the 1920 program.

The original program consisted of approximately eighty miles of concrete highway. Only about half of this has been placed under construction. After carefully considering the present situation, it seemed somewhat doubtful about placing any more concrete highways under construction on account of the lack of cement shipment. No difficulty has been experienced in securing asphalt and stone shipments. Therefore, it was agreed that the program should not be held up, but that the highway should consist of a bituminous foundation and asphalt wearing surface. Plans are now being completed, and proposals will be called some time about the middle of August. There will be approximately forty miles of road in this experiment. A smaller experiment consisting of approximately fifteen miles of asphalt surface road was tried out in Sussex county, Delaware, and the results proved very gratifying to the users of these highways.

It was hoped that the main system of the State could be constructed of concrete or concrete foundation, but the demand for the completed roads and the condition of cement shipments have made it necessary to consider asphalt construction.

Immigration Bill 14196

House Bill 14196, prepared by the National Committee for Constructive Immigration Legislation, has been referred to the Committee on Immigration and Naturalization for consideration during the Congressional recess.

The bill was framed with the intent to avoid both complete suspension of immigration and free immigration. Its provisions are based on justice and good will as well as on economic and political considerations, and on the principles that American standards of living must be protected, that only so many shall be admitted as can be steadily employed and that steps must be taken to promote the rapid and genuine transformation of aliens into American citizens.

The bill creates an Immigration Board of six, five of whom are members of the president's cabinet. The board is to have the power to determine yearly the maximum number of immigrants of each people and nation to be admitted. The decision of the board shall be based upon:

1. The demonstrated assimilability of each people as shown by naturalization satistics.
2. Labor conditions in the United States.
3. Maintenance of American standards of living.
4. The fitness and availability of each people for general localities.

The board is required to study and report upon the question of distribution of immigrants.

Distinction is made between transients and immigrants.

Standards of naturalization are raised and the privilege of citizenship is offered to *every* one who will duly qualify.

Laws now existing that contravene our treaties, that discriminate between peoples and that are in conflict with the above provisions are repealed.

The proposed legislation would do away with the discrimination now in force against Chinese and Japanese and put them on the same immigration and naturalization basis that other peoples occupy under the law.

John H. Norris

John H. Norris, for many years chief engineer of the National Meter Company, died very suddenly at his residence in New York City, on June 21st.

Mr. Norris was a man well known to water works officials throughout the country, and was a recognized authority on water meter problems of all sorts, which he handled with invariable patience and success. He was associated with the National Meter Company for over thirty years.

He was unassuming, quiet and dignified at all times, and ever ready with a kind word or act for associates and acquaintances. His unexpected death at the height of his usefulness leaves a vacancy that it will be difficult to fill.

Mechanical Equipment for Highway Construction

By K. H. TALBOT[†]

Unloading aggregates from railroad cars by hand, bucket elevators, derricks and cranes, and transporting it to the mixer are considered. The automatic water measuring tank and the batch meter are recommended.

UNLOADING FROM RAILROAD

The unloading of materials at the railroad station offers a problem in design of plant. The method of handling the remainder of the job will in a large degree determine the economical type of unloading equipment. The methods employed for unloading materials may be divided as follows: First, unloading by hand into either wagons, trucks, or movable hoppers that are hung against the side of the car and from which the material is dumped into trucks or wagons; second, mechanical unloading, using bucket elevators or skip hoists from pits below the track; third, clam-shell bucket operated by a stationary derrick; and fourth, the use of a portable crane. The first and second of these methods have been very successfully used where comparatively small amounts of materials were handled or where the material could be obtained in bottom-dump gondola cars, but will not give the required capacity where the storage must be at the railroad station and not on the sub-grade. The fact that labor is expensive and difficult to get makes it desirable to use labor-saving devices wherever possible. It is recommended that consideration be given to the derrick and the crane.

The guyed derrick has many advantages over the stiff-legged derrick for this class of work, as it is possible to swing through 360 degrees and store materials behind it. Stiff leg derricks are being used successfully but the shorter swing is a disadvantage. If stiff leg derricks are used, however, they should be set up with one leg parallel with the railroad track so that maximum advantage can be taken of this swing radius.

There are two types of cranes which have been used extensively, first, the locomotive crane operating on railroad tracks and handling materials to stock piles parallel with the track and from them or from the cars into measuring bins; and second, the auto cranes which operate either on traction wheels or caterpillars. Either of these machines is satisfactory, the location, quantity to be handled and general conditions determining which to use. Speed of movement and ability to store a considerable quantity of material are essential features.

There have been many advocates of the use of tunnels in connection with locomotive cranes. The expense of such tunnels, however, does not seem to be justified as against the use of open bins holding between one and two industrial train-loads of material, as the latter are portable to the extent that they can be picked up with the unloading crane or derrick, loaded on to cars and shipped to the next job. They have the advantage of being easy of access, allowing the men to work in the sunshine instead of darkness and of being easily cleaned in case of any clogging. The placing of the loading bins on flat cars offers many advantages where a locomotive crane is used, as it makes possible the moving of this bin to any place desirable for loading, dependent only on the location of the car to be unloaded.

A word of warning on the design of unloading plants may not be out of place here. In the past, many contractors have made the mistake of designing their unloading plants with too small storage capacity to allow the crane to store materials as rapidly as they can be obtained. For a one-mixer operation, it is recommended that a contractor have on hand a storage of at least 2,000 tons of stone and 1,000 tons of sand and that he equip with an unloading plant having a capacity of at least 300 cu. yds. of material per day.

The expenditure of large sums of money for plant requires that all parts be nicely balanced. Many men have found large equipment expensive and have finished the job with a loss because their plants were not balanced. For instance, they may have had a large unloading plant and a small mixer, a large mixer and a large unloading plant but poor transportation facilities for handling the materials to the mixer, or they have purchased and gone into the industrial railway not affording themselves sufficient storage at the unloading plant to keep going when deliveries were slow.

With a central proportioning plant, the use of bulk cement has proven very efficient. The materials in this instance are usually shipped in gondola cars with tarpaulin covers, unloaded with the clam-shell that unloads the aggregate, and placed in overhead bins from which it is measured by volume into the batch boxes.

The demand for mechanical equipment is the outcome of the desire of the contractor to reduce the number of men required to build a mile of road per mixing unit. This has brought to the fore larger mixers in order that the unloading and hauling equipment may be used to its full capacity. A mixer holding 28 cu. ft. of concrete equipped with a boom and bucket and charged with a crane, having a capacity of from 100 to 125 ft. of 16-ft. road per hour, has been built. Roads have been built at this rate in Michigan. One batch box is used for each industrial car instead of two used with the smaller.

[†] Of the Kochring Machine Co.

[*] Concluded from the June 26 issue, page 572.

machine. The design of the large mixer has been materially changed from that used for the paver with a capacity of 14 to 21 feet, in that the boxes are picked off cars with a separate crane and dumped into a batch hopper above the mixer. In this way one operation is done away with, that of lifting the charging skip.

On machines of 10, 14 and 21 ft. capacity, the derrick operated by a power hoist swings the boxes from the car into the loading skip, after which the empty box is swung back and the materials hoisted into place. In this way it is possible to use a standard mixer which may be used either with wheelbarrows or with loader as well as with industrial railroad. The use of a separate crane with the smaller mixers is not economical, as the output is not commensurate with the cost.

MIXING

Based on laboratory results, many state highway departments specified the use of concrete having a dry consistency, but the results of this year's work point out the desirability of accepting a workable consistency rather than an excess or deficiency of water. In the field the advantage in strength of concrete due to reduced water is offset by the added expense involved in handling the concrete. The boom and bucket distributing system has proven the most enonomical method of placing concrete on the grade and in the ability to place the concrete on the sub-grade with one-man control.

To guarantee standardized concrete two automatic features have been incorporated into the mixer, first an automatic water measuring tank, so built that the quantity of water can be controlled and the same amount used for each batch; and, second, the batch meter, which controls the time of mixing.

The measuring of the water is accomplished by filling the water tank to its full capacity and then drawing it down to the bottom of the discharge pipe, the elevation of which can be changed to give the required amount of water. The tank is located crosswise of the machine, so that the quantity of water per batch is the same regardless of whether the machine is traveling on a level of the road or on a grade. In order to insure uniform quantity of water per batch, the operator should open the valve into the mixer as soon as the last of the preceding batch has been discharged and leave it in this position until he has lowered the charging skip. This will give the proper time for discharge of water and insures uniform consistency of the batch. If, on the other hand, the operator does not open and close the valve at regular intervals, one batch will be dry because the tank has not emptied and the next will have the desired amount of water. The result will be a varying consistency.

The batch meter insures the time that the batch remains in the drum of the mixer, locking the discharge chute when the material enters the drum and releasing it at the expiration of the time specified. Announcement of the fact is made by the ringing of the bell.

Reference has been made to the desirability of the use of machinery as a pace-maker for the crew. One contractor found this year that he was making time and getting out yardage by organizing his crew around the batch meter. The basis of all efficient engineering is time study and timing of operations. The batch meter offers the contractor a time control for his forces.

Luten Bridge Patents Held Invalid

In holding all the Daniel B. Luten patents involved in the suit at issue as invalid, the United States Circuit Court of Appeal for the eighth district recently, in a sweeping decision upholding the verdict in the district court of the United States for the district of Nebraska, scathingly scored Luten and the National Bridge Company for their methods of advertising and exploitation.

Comments of the court in the recent decision are interesting. The following are a few brief extracts:

"We have examined the patents here directly involved and the others contained in the record, and the numerous patents of the plaintiff which have been described in the cases to which we have referred. We are convinced that they are all void for want of patentable invention."

"Insofar as we can discover, none of the Luten patents has ever been sustained in a contested case, and they have been frequently held to be invalid for want of general patentability. Notwithstanding this experience, these patents have been exploited by skillful campaign of advertising in which it has been repeatedly asserted that no suit based on a Luten patent has ever been lost or dismissed. This work has been done through the agency of the National Bridge Company of Indianapolis. The record in this case leaves no room for doubt that the entire scheme by which it has promoted these patents has been fraudulent."

"While Mr. Luten has made no invention, he has made a great discovery, namely, that not more than one city or county attorney or attorney general in ten knows anything about patent law or the proper interpretation of consent decrees in that field. It has resulted that cities, counties and states have been easy victims for the peculiar arts of the National Bridge Company, for they were without trustworthy legal advise. With the above element to play upon it has been easy to convince public authorities that the way of safety was the way of wisdom and that this consisted in employing Mr. Luten as an engineer or paying him ten per cent royalty for the use of his patented device."

"A continuation of the bridge company practices under these void patents would be a grave wrong."

The fight against Luten and his patents was started by the Iowa Highway Commission, assisted by Harry E. Sampson, then assistant attorney general, some six or seven years ago. Previous to that time no determined fight had ever been made on these patents, which the commission believed to be invalid. Contractors, towns, cities and counties, when threatened with infringement suits, had invariably settled out of court rather than attempt an expensive fight in defense. The Highway Commission engineers, aided by the attorney general's office, collected the evidence necessary to show the invalidity of the patents. Since the collection and preparation of that evidence, Luten has never won a single suit in any state.

State Hires Road Contractors' Equipments

Contractors and their outfits were hired by the Commissioners of Iowa to perform road work, and this proved so satisfactory with two outfits last year that five are being hired this year.

Last year Iowa inaugurated a road building experiment which was believed to be unique in that two independent individual contractor's outfits were hired with which to build the Montgomery county Federal-Aid road, instead of contracting for the construction of the road with the contractors. The experiment proved so promising in its preliminary tryout that this year five separate complete outfits have been hired and put to work in order to rush completion. The experiment is unique in that, so far as the state, federal and county officials concerned know, it is the first and only one in which such a system has been tried out.

The experiment is an effort to find out under actual working conditions what it costs, under fair average conditions, to do road grading work and, incidentally, to have some definite and reliable basis upon which to approve or disapprove prices on such work offered by contractors at road lettings.

For a considerable time before the work was undertaken last year, bids received on road grading work ranging as high as 55½ to 60c. per yard had been considered by the commission to be too high. When on July the low bid on the 216,000-cubic-yard job of earth moving in Montgomery county was found to be 55 cents, the state and county officials decided to reject all bids and make a counter proposition to the two low contractors, P. J. Ryan, of Des Moines, and E. J. Wilson, of Council Bluffs. The proposition was to hire their entire outfits and equipment, owners included, for a stipulated sum. The commission agreed to stand all labor hire, all bills for groceries and provisions, horse feed, and repairs (except harness repairs) on the equipment. Ryan and Wilson, the owners, were each required to give their entire time to the management of their own outfits under constant direction of the commission's resident engineer, B. J. Condon, a former Montgomery county engineer.

The work started on July 20. Good weather and good working conditions enabled the crews to make an unusually low record for the first few weeks, dirt being moved for as low an average as 30 cents. Later, more difficult work was encountered. Work in the hills in the vicinity of the Nodaway river became very expensive. Sand had to be removed for long stretches and earth filled in to build up the grade. There was a great deal of grubbing and removal of trees and stumps. Over 2,500 sticks of dynamite were used. A blasting gang was kept busy during almost the entire working time. There was one 13-foot cut and one 16-foot fill. By the end of the working season the most difficult work of the entire job had been completed. Eighty thousand yards of earth had been moved for a total of $50,978.56 or an average of 52 cents per yard. The figures up to this point in a way justified the bids by the contractors of 55½ cents at the letting.

Last year there were the two outfits, of Mr. Ryan and Mr. Wilson. Each had an 18-team elevator grader outfit. Three more similar outfits have been contracted for this season and at present the five outfits are all at work. The job was, so far as known, the first large federal-aid job to get under way in the state this year. With the great advance in prices for labor, supplies and food, the engineers in charge, it is feared, will have a difficult time in holding the cost down to last year's figures. However, the most expensive work has been completed. What remains is comparatively easy excavation and reasonably short hauls. With a good early start with the five outfits with their hundred head of horses and mules, their 75 or 80 men, and equipment all in good shape as a result of careful overhauling during the winter, the work will be rushed to completion just as quickly as possible.

Incidentally, the carrying of the job over into the 1920 season will give an opportunity to find out what work is going to cost under this season's working conditions and form a reliable standard upon which to pass judgment upon 1920 grading prices. The figures obtained up to the close of work last season of 52 cents per yard in a way justified the low price bid at the letting of 55½ cents. It is hoped, however, even under present conditions, to lower this average somewhat and show a substantial saving.

Incidentally, it will be a matter of satisfaction to have at hand actual cost data on earth excavation and road grading on a job of such magnitude, as a basis upon which to approve or disapprove bids offered by contractors at road lettings.

Texas Highway Plans

The total contracts let by the Texas State Highway Department for 1920 to date amount to $8,500,000 and call for the construction of approximately 700 miles of highway. There are at present 183 active federal aid projects and 120 state aid projects in the state involving the construction of 2,500 miles. The state highway department has approved plans for federal aid work on projects aggregating $6,500,000, of which amount the federal bureau of public roads has formally approved $2,520,486 worth of improvement.

Up to date more than 20,000,000 square yards of concrete pavement contracts have been awarded in the United States since January 1, 1920. The awards for the week ending May 1, aggregated $2,863,800.

A bond issue of $15,000,000 to construct street car subways in Cleveland has been voted down.

Some Developments in Brick Road Construction*

Setting forth the advantages of the standard lugless paving brick, and predicting that foundations will soon be adapted to the soil under them and the load they are to carry.

In cooperation with engineers, the paving brick manufacturers have taken the lead in bettering their product, improving the details of brick pavement construction and insisting on good specifications being lived up to.

STANDARD SIZE AND SHAPE

One of the recent steps in the betterment of the brick themselves is the adoption by the manufacturers of a standard shape and size of paving brick suitable for use under all conditions of traffic and method of construction. It is a square edged, side wire-cut, lugless vitrified brick 3 x 4 x 8½ inches, laid either on edge, making a four-inch depth wearing surface, or flat with three-inch depth, after the principle of vertical-fiber brick which, for the past eight years, has been used successfully in states west of the Mississippi. From the manufacturers' standpoint, this standard size is much the most economical to make and burn, the cost is less per ton than for other sizes, and by avoiding making specially shaped or sized or patented pavers, the plant efficiency is much increased, thus making a further reduction in costs.

On the other hand, the purchasers get a more uniform product, a better quality of brick material, and one structurally stronger. The same sized brick can be used to provide either a four-inch or three-inch depth of wearing surface, while the square edges and straight surfaces provide a uniform width of joint from top to bottom for either cement grout or bituminous fillers.

This style of paver is the result of years of experience in the manufacture of paving brick and is recommended for use. It is not being "foisted" upon the "unwilling" public as some would have it believed. The older types of pavers can still be obtained, but it is the best judgment of many of the manufacturers, and of those engineers who have had sufficient experience in their use to be able to express an opinion, that this "new" standard is a distinct forward step, and should be given first place in specifications.

Most of the objections to its use are based on the absence of lugs. In all other block pavements, the modern tendency is to get the joints as narrow as possible and eliminate rough riding and cobbling. Lugs have not been an insurance against improper grouting—the only insurance in this respect is proper care in selecting the sand, mixing and placing. If these ordinary, well established precautions are taken in grouting, good results will be obtained with narrow joints and a smoother, more durable pavement secured. In practice, the process of setting the brick in the cushion and especially of rolling, slightly spaces the individual brick and provides ample space for a cement grout, using fine sand and of the proper consistency, to penetrate to the bottom of the joint. With a bituminous filler, of course, the narrower the joint the better.

As stated above, paving brick manufacturers west of the Mississippi have been making this style of paver for the past eight to ten years, and since 1916 without lugs. The lugless feature was adopted at the request of city engineers who had been using asphalt filler exclusively but has since been used with grout filler in the comparativey few instances where grout has been specified, without a failure to the writer's knowledge.

FOUNDATIONS

The near future will see the passing of the so-called standard designs of roads as far as the foundations are concerned, and we will no longer have standard foundations applicable over a whole state, or over a whole county or even over a single road of any length. Economical foundations are a matter of more serious consideration than is usually given them by highway engineers. On the other hand methods of construction and other features of the wearing surface will in the near future be much more thoroughly standardized between states as well as other civivc units than they are at present. In other words, if the sub-grade preparation and foundation construction are such that, under conditions of traffic, the wearing surface is always given the same chance to maintain a smooth, uniform condition best adapted to resist impact, speed and wear, the same depth and detail of construction of the wearing surface would apply as well in one locality as in another where climatic and traffic conditions are alike. On the contrary, foundations will be constantly varied to take care of the continually varying subgrade.

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*Abstracts from a lecture delivered before engineering schools by Clark R. Mandigo, chief engineer, Western Paving Brick M'f'rs Ass'n.

Seven Millions of Public Work in Philadelphia

The total cost of work under contract and under way in Philadelphia since early January on municipal improvements, including paving and construction of sewers, bridges and water supply systems, is $7,030,636 This amount covers 278 contracts, 164 of which, totalling $3,638,250, were for paving work. Seventy-two contracts are for sewers, and contracts awarded by the Water Bureau total 34.

The Niagara Peninsula branch of the Engineering Institute of Canada is planning for a meeting to be held at Niagara, Ont., September 16, 17 and 18, at which 500 engineers from all parts of the dominion are to be present. The branch has just closed a successful year, having greatly increased its membership.

Natural gas from a local well will probably be utilized for fuel in the municipal electric light and power plant and pumping station at Brownwood, Tex.

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A Disgraceful Financial Policy

The protest on page 15 against the continued delay on the part of the city of New York to keep its sacred pledge or to pay just debts long overdue, is put in strong language but none too strong. The stinging rebuke is well merited and ought to arouse enough public attention to compel the prompt settlement, at this late date, of the claims in question.

The facts are that at the entrance of the United State into the world war there were more than thirty important subway contracts under construction, most if not all of which had been very seriously delayed by the changed conditions brought about by the war, that had already resulted in a heavy increase of the cost of labor and materials to the contractors above those costs which prevailed when the contracts were awarded, and which could not at that time be foreseen. This necessarily involved heavy losses to the contractors who were prepared to accept them and who were faithfully performing their obligations notwithstanding the fact that in many cases they had suffered great additional hardship through unexpected changes and delays in the drawings, specifications and other requirements that dragged the work along that might otherwise have been concluded much more economically under the former prices.

Some of the contractors were already in distress, and all of them had suffered considerably so that relief was called for, and on June 15, 1918, the Board of Estimate specifically promised the representatives of the contractors that if they would complete the work, of which the city then stood, and in some cases still stands, in urgent need, just payment should be made for it and additional costs to the contractor should be assumed by the city.

On the strength of this formal official assurance, equivalent legally to a contract, the already embarrassed contractors went on and spent more than $7,000,000 with the expectation of speedy reimbursement. This was such a heavy drain on their finances that several of the contractors, some of whom had thus expended $2,000,000 each, were greatly embarrassed and some of them barely escaped positive bankruptcy, being greatly crippled in their subsequent operations. Nevertheless, after more than two years, less than 10 per cent of these just claims have been paid by the city and there appears to be very slight inclination of the responsible officials to liquidate these claims.

In former years contractors with the highest reputation and long city records for honest, efficient, prompt work had great difficulty in collecting just bills from the city, and have been obliged to resort to slow and costly litigation, and have generally felt that in many cases the policy of the city is to throw the greatest possible responsibility on the contractor, regardless of the merits of the case, and to pay him as little as possible and as slowly as possible for the work regardless of the just compensation.

That such conditions can prevail in New York or any other American city is not only disgraceful but perilous in that, besides discouraging the efforts of loyal and efficient contractors, it encourages a most dangerous disregard of honest obligations that is little if any less mischievous than the deliberate violation of its contracts by labor.

Profitable Co-ordination of Practical and Theoretical Considerations in Waterworks Design

There is commenced in this issue a paper on the design of the Winnipeg Aqueduct which, properly interpreted, is remarkably illuminating in its presentation of the manner in which exceptionally satisfactory technically and financial results were obtained in the design and construction of a great water supply system.

To a very thorough preliminary investigation of the subject were added a keen analysis of conditions and a judicial equating of difficulties, advantages and requirements, which enabled the design to be made in such a way as to co-ordinate the possibilities of construction and operation. The result has been the eminently successful construction, during the worst of the war period, of a large and costly aqueduct and appurtenances practically within the originally estimated time and cost, executing the work with great rapidity and excellence and providing a high-class durable structure with a capacity more than 17 per cent greater than was called for.

The Winnipeg Aqueduct, built through uninhabited wilderness, under difficult topographical and climatic conditions, consists of eighty miles of horseshoe shape gravity concrete construction and seventeen miles of circular reinforced concrete pressure pipe which, with its appurtenances, was built and put in operation in four years and five months after the award of the contract at a cost of about $15,000,000 and with a capacity for furnishing 100,000,000 imperial gallons of water daily.

In its construction about $1,000,000 was saved by means of a careful analysis of the effects of the grade on the size and cost of the aqueduct, which resulted in making the total length about 8 per cent longer than that of a straight-line location. An important saving was effected by dropping the hydraulic grade line, at the junction of the flat and steep grades, so as to reduce the maximum depth of cut 1 foot for the 9-mile summit section 22 feet deep in difficult ground covered wtih swamp.

Another important feature is the delivery of daily supply up to 25,000,000 gallons to the Winnipeg reservoir without pumping, by the construction of a pressure aqueduct 15 miles long across the Red river valley. Provisions for future increased supply can be made by the installation of a pumping station which, increasing the velocity of flow through this section of the aqueduct from 1½ feet to 4 feet per second, will deliver 50,000,000 gallons of water daily.

In designing the aqueduct the coefficients used in the computations of the Nashua Aqueduct were adopted as reliable and conservative. The capacity calculated by them was about 95 per cent of that for an aqueduct of the same dimensions as the Nashua aqueduct. This value proved to be entirely on the safe side when measurements of actual flow through the completed aqueduct showed a capacity of 100,000,000 gallons per day instead of the 85,000,000 gallons indicated by the computations.

A Cause of Labor Shortage

An important, if not the principal cause of labor shortage in this country, is the preposterously high wage and short hours that is increasingly prevailing. The high wage enables the laborer to secure enough for his necessities in a very short time, permits him to indulge in vicious and extravagant practices, greatly demoralizes his general attitude, breeds a dislike for industry, and affords ample leisure for all kinds of mischief.

The short hours decrease the amount of production much more than their nominal diminution of working time because, no matter how short they are, they carry practically the same actual amount of overhead loss in beginning and stopping work and in various other items of lost time that are scarcely greater in a 10-hour day than in a 6-hour day. Therefore in order to maintain the same production a disproportionately larger force of men is needed and the supply, depleted by decreased immigration, is insufficient.

Two recent examples thoroughly prove these statements, namely the renewed demands of the Chicago garbage collectors for an increase from $4.40 to $5.60 per day, and their rejection of the offer of $4.76 and threats for a renewed strike which could only be maintained by reason of a surplus from excessive wages sufficient to enable them to live in idleness while the city suffers for their services. The same is true of the striking longshoremen in eastern cities who are maintained in comfort from the same source and have enjoyed a long season of complete idleness, turbulence and discontent. It does not take a very long memory to go back to the times when, it is common knowledge, that many strikes were called on the flimsiest pretext, and when after a longer or shorter vacation the men returned to work on their own terms, the employers were forced to pay them besides the increased wages, their full pay for all of the "waiting time" they were idle on strike. With all of this necessarily comes the greatly decreased efficiency of labor as illustrated by the specific case of the average bricklayer who in 1914 laid 1,900 bricks a day for $5 and now lays 800 bricks for $9.

The legitimate results of this evil condition are emphasized in Chicago, where with the 1920 budget already over-appropriated by $4,500,000, new wage scales are demanded by the unions that average a 20 per cent increase and, if granted will add nearly $1,000,000 to the already impossible budget. If not granted, the unions will probably encourage strikes that will endanger the safety of the city.

There can be but one answer to this rapidly growing evil, namely legislation must be made and enforced to prevent and severely punish strikes of government, municipal or public utility employees; labor unions must be incorporated; immigration must be encouraged and increased; existing laws must be uniformly enforced without exemption for labor unions or truckling to their political support; and employers must combine solidly and refuse to pay inordinate wages or to accept inefficient, unreliable service.

Meeting Labor Shortage

The water department of New Bedford, Massachusetts, needs twice as many laborers as it can secure and its superintendent, Steven H. Taylor, says that "out of one lot of 80 names of eligible laborers, we got 8 men, and 4 of them quit at the end of the first day's work." Most of the eligibles notified that work is ready for them reject pick and shovel jobs and wish to be watchmen or water carriers, although the pay for laborers is now $4.50 per day.

To meet this condition the city has purchased a steam shovel which will replace a large quantity of labor now required for excavating work, and it has also contracted for a new pipe joint compound that will greatly reduce the amount of labor required in laying new water mains, because it will eliminate the time of two men for two hours to calk every joint of a large pipe.

Experience With Chinese Labor

Santa Rosa, California.
Editor Public Works: May 27, 1920.

Dear Sir—

I have used Chinese labor to a limited extent in contracting and also in farming. On construction work I have found this class of labor fairly reliable and honest, and when used for hired help on the farm I have known them to be unreliable and absolutely dishonest.

Chinese or Japanese on coming to this country wish to get in possession of the land, and when working for wages on the farms do all they can to impoverish the land. They damage your plants and your trees, and they pack your fruits and vegetables so wretchedly that no profit can be made where they are employed.

When the owner's profits have become unsatisfactory, they lease or buy the land and by the greatest of industry proceed to enrich the soil; they raise wonderful crops and they finally gain control of the market for food stuffs. When they have the control they make their own price to consumers. Potatoes are now eight cents per pound in California and a Japanese is potato king.

These races are natural farmers and it will be a bad thing for this country as they extend their ownership or control of the soil.

If laws would be passed prohibiting Asiatics from owning or leasing the soil, and also prohibiting citizenship to Asiatics born in this country, I would favor their admission to our country. Otherwise I am opposed.

My principal business is contracting, but also engaged in farming.

Yours very truly,
G. W. Conners,

Effect of Shortened Working Hours

The records of the Federal Reserve Board show that the production of raw materials in this country was 10 per cent less in 1919 than in 1918, and that the production of fabricated material was 25 per cent less.

In investigating this subject the New York *World* has concluded that the principal factor is the shortened hours of work inaugurated during the war. "In every instance, almost without exception, where a decrease of production is shown," says the investigator, "there has been a reduction in the number of hours of work each day of each week." In many cases the decrease was found to coincide strikingly with the actual shortening of the working day, as for example a factory reducing its output 20 to 25 per cent when the working day was changed from ten hours to eight.

To Stabilize Construction

The Employers' Association of Manitoba has issued the following "statement of aims": (1) to promote industrial peace, commercial prosperity in the community and the steady employment of labor; (2) to discourage lockouts, strikes, and unfair demands by either employer or employee; (3) to secure for employer and employee freedom of contract in employment; (4) to disseminate knowledge of fundamental economic laws.

Wage Maximum for Construction Workers

The weekly edition for June 12th of the Bulletin of the Associated General Contractors' of America, devotes considerable space to construction wages and gives a table of rates in 21 cities in 17 states, in which the maximum and minimum hourly union rates are, for masons, $1.50, Shreveport, Louisiana; 85c, Richmond, Ind.; bricklayers, $1,50, Shreveport, La.; $1.00, Washington, D. C.; structural iron workers, $1.25 in several cities, 98c, Washington, D. C.; ornamental iron workers, $1.25, St. Louis and Cleveland, 87½c, Seattle, Washington; reinforcement rod setters, $1.25, St. Louis, Omaha, Fargo and Cleveland, 87½c, Seattle; plasterers, $1.50, Shreveport, La., 87½c, Richmond, Ind.; wood lathers, $1.25, San Jose, Calif., $1.00 Washington, D. C.; metal lathers, $1.25 in several cities, $1.00 Washington, D. C.; hoisting engineers, $1.25 Omaha and Cleveland; 65c, Waterloo, Iowa; tile setters, $1.25 Springfield, Illinois, and Sioux City, Iowa; $1.00, Washington, D. C.; plumbers, $1.50 Dallas, Texas; 87½c Aberdeen, S. Dak.; carpenters, $1.25 Cleveland, 85c Richmond, Ind.; stone cutters, $1.25 Dallas, Texas, 80c Aberdeen, S. Dak.; marble cutters, $1.12½c San Francisco, 67½c. St. Louis; painters, $1.10 Omaha, 75c Richmond, Ind.; electrical workers, $1.25 Omaha and Cleveland, 80c Aberdeen, S. Dak.; roofers, $1.25 San Jose, Calif., 75c Shreveport, La.; cement finishers, $1.25 in several cities, 90c in several cities; elevator erectors, $1.25 St. Louis, 90c Washington, D. C.; pipe coverers, $1.12½ Cleveland, 75c Springfield, Ill.; hod carriers, $1.12½ San Jose, Calif., 60c Shreveport, La.; laborers, 87½c Cleveland, 40c Atlanta, Ga.

At San Francisco, the agreement between the unions and the general contractors has expired and new demands are being made for plasterers at $1.56¼, structural iron workers and hoisting engineers $1.25, carpenters $1.12½, hod carriers $1.25 and laborers 81¼c.

At Washington, D. C., a bonus of $1 per day above wage scale is being paid to bricklayers and plasterers.

In Cleveland plumbers are on strike for an increaes to $1.50 from $1.

In San Francisco, plasterers are demanding a raise from $1.25 to $1.56¼. Structural iron workers, hoisting engineers and plasterers are demanding $1.25.

In Springfield, Illinois, the efficiency of workmen is reported at about 50 per cent. In Seattle, Washington, where voluntary limitation of output was practiced under the closed shop, a notable increase in the efficiency of labor has been developed since the Master Builders' Association declared for open shop.

For the loss of a hand, compensation of $4,128.48 to be paid at the rate of $19 per week for 244 weeks has been awarded by the compensation commission, New York.

The Interstate Commerce Commission has declared an embargo on cars for shipment of bituminous coal to Lake Erie ports for transshipment by water, except on a permit.

The embargoes recently declared by several eastern railroads are attributed by them to insufficient ships and to the unusually large number of cars in transit especially coal cars. The longshoremen's strike is not, however, assigned by them as a cause for the congestion.

Dishonest Municipal Treatment of Loyal Contractors

In a recent official letter addressed to the Board of Estimate and Apportionment of the city of New York, T. A. Crane, secretary of the General Contractors' Association, called attention to the fact that the report of the committee on finance and budget of the Board of Estimate and Apportionment submitted May 28th, while dealing with claims for labor and materials furnished to the Board of Education in 1918, and for which payment has not yet been made because of no request for an appropriation to cover them, stated that on June 15, 1918, the Board of Estimate promised the Contractors' Association that if the contractors would carry to completion the subway work then under construction, they should receive just compensation and that unexpired contracts should be modified or supplemented if completed within a reduced time limit and that compensation should be to equal the increased cost of labor and materials due to the war.

Although the contractors have loyally fulfilled their part of this agreement and have spent more than $7,000,000 of their own money, largely on credit, to complete subway work, many sections of which have been finished and are now in operation, Mr. Crane says:

"The Board of Estimate, in refusing to carry out its agreement, has swindled those who relied on its integrity. The disgraceful admission must be made that the word of the City of New York, as given by the present administration, is good for nothing; that the mayor and comptroller are willing converts to the Berlin idea that a promise is merely a scrap of paper.

"The situation is one in which the good faith of the city, as pledged by the Board of Estimate, is involved. Accepting the promise as made in good faith, the contractors went ahead with their work and many of the sections were completed and are now in operation.

"Thus far only four settlements have been made, two of them on the large contracts and two on small ones, involving less than $700,000. For some reason, best known to the Board of Estimate, some thirty other subway contracts, equally meritorious, have not been settled and efforts to secure settlement, either under the promise or through legislation, have persistently been blocked by the city administration."

The U. S. Shipping Board refused the increased wages demanded by 4,000 striking longshoremen at Philadelphia and against similar demands of the shipyard workers on the Pacific Coast and the strikes are reported as broken and the men as returning on open shop basis.

Regulation of Immigration

At the recent international conference, action to co-ordinate existing governmental immigration activities was taken by the 500 delegates from 30 racial groups working with prominent leaders in industry, finance, agriculture, labor and education

It was proposed to create a board of assimilation to facilitate the distribution of immigrants and to Americanize them. The repeal or modification of the literacy test was urged as was the enforcement of immigration laws directed against anarchists and their like. It was stated that investigations confirmed the fact that our foreign born residents as a class are law abiding, industrious and thrifty, and measures were endorsed to provide for the compulsory education of immigrants.

Extensive Housing Construction

All kinds of construction work would be greatly benefited by the rapid amelioration of the housing difficulties that have been steadily increasing in most parts of the country and especially in New York City. The New York Mayor's Housing Conference Committee announces that speculative builders promise to keep operating at cost, irrespective of immediate profits, if mortgage money is forthcoming and if labor promises a fair day's work for a fair day's pay. Three thousand six hundred and fifty lots have been pledged, subordinate to mortgage, and the Board of Estimate and the State Legislature will be asked to help all public buildings until the housing shortage is overcome.

Efforts are being made to exempt new buildings from taxation for a stated period and labor will be asked only to continue its arrangement as to wages and hours for one year or until the completion of the operation on which the men may be engaged. It will be remembered that previous generous efforts for building construction were immediately met by the labor unions by demands for increased pay and for the rejection of all building materials that had passed through non-union hands.

Proposed Regulation of Industrial Relations

A committee of prominent and influential members of the United States Chamber of Commerce has prepared a statement of twelve propositions for the government of American industrial relations, which have been submitted for a referendum vote to more than 1,300 industrial and commercial organizations included in the Chamber of Commerce of the United States.

This committee was appointed after the adjournment of the first industrial conference called by President Wilson, and its proposals are intended to include the fundamentals of employment relations. The referendum carries references to arguments in the negative so that voters may be able to study the recommendations fully before voting is closed at the expiration of forty-five days.

The commitee's report recognizes the necessity for justice, equality and individual liberty; that the terms of employment should conform to the essential requirements of economic law and sound business practice; that they should conduce to mutual interest and higher productive efficiency; and should realize broad ideals of individual and social betterment. Orderly government and public service must be assured and the paramount interest of the public protected. With these considerations in view, the committee states its belief in the following principles:

"1. Any person possesses the right to engage in any lawful business or occupation and to enter, individually or collectively, into any lawful contract, either as employer or employee. The rights are subject to limitation only through a valid exercise of public authority.

"2. The right of open shop operation, that is, the right of employer and employee to enter into and determine the conditions of employment relations with each other, is an essential part of the individual right of contract possessed by each of the parties.

"3. All men possess the equal right to associate voluntarily for the accomplishment of lawful purposes by lawful means. The association of men, whether employers, employees or other, for collective action or dealing, confers no authority over, and must not deny any right of those who do not desire to act or deal with them.

"4. The public welfare, the protection of the individual and employment relations require that associations or combinations of employers or employees, or both, must equally be subject to the authority of the State and legally responsible to others and that of their agents.

"5. To develop with due regard for the health, safety and well-being of the individual, the required output of industry is the common social obligation of all engaged therein. The restriction of productive effort or of output by either employer or employee for the purpose of creating an artificial scarcity of the product or of labor is an injury to society.

"6. The wage of labor must come out of the product of industry and must be earned and measured by its contribution thereto. In order that the worker, in his own and the general interest, may develop his full productive capacity, and may thereby earn at least a wage sufficient to sustain him upon a proper standard of living, it is the duty of management to co-operate with him to secure continuous employment suited to his abilities, to furnish incentive and opportunity for improvement, to provide proper safeguards for his health and safety and to encourage him in all practicable and reasonable ways to increase the value of his productive effort.

"7. The number of hours in the work day or week in which the maximum output, consistent with the health and well-being of the individual, can be maintained in a given industry should be ascertained by careful study and should never be exceeded except in case of emergency, and one day of rest in seven, or its equivalent, should be provided. The reduction in working hours below such economic limit, in order to secure greater leisure for the individual, should be made only with full understanding and acceptance of the fact that it involves a commensurate loss in the earning power of the workers, a limitation and a shortage of the output of the industry and an increase in the cost of the product, with all the necessary effect of these things upon the interests of the community and the nation.

"8. An adequate means, satisfactory both to the employer and his employees and voluntarily agreed to by them, should be provided for the discussion and adjustment of employment relations and the just and prompt settlement of all disputes that arise in the course of industrial operation.

"9. When, in the establishment or adjustment of employment relations, the employer and his employees do not deal individually, but by mutual consent such dealing is conducted by either party through representatives, it is proper for the other party to ask that these representatives shall not be chosen or controlled by, or in such dealing in any degree represent any outside group or interests in the questions at issue.

"10. The greatest measure of reward and well-being for both employer and employee and the full social value of their services must be sought in the successful conduct and full development of the particular industrial establishment in which they are associated. Intelligent and practical co-operation based upon a mutual recognition of this community of interest, constitutes the true basis of sound industrial relations.

11. The State is sovereign and cannot tolerate a divided allegiance on the part of its servants. While the right of government employees--national, state or municipal—to be heard and to secure consideration and just treatment must be amply safeguarded, the community welfare demands that no combination to prevent or impair the operation of the government, or of any government function shall be permitted.

"12. In public service activities, the public interest and well-being must be the paramount and controlling consideration. The power of regulation and protection exercised by the State over the corporation should properly extend to the employees in so far as may be necessary to insure the adequate, continuous and unimpaired operation of public utility service."

Engineering Experts Recommended for Labor Unions

In an article by M. L. Cooke recently published in the *New Republic*, a plea is made for participation by labor in the management and administration of production, and it is admitted that such management needs the assistance of outside engineers and other experts practising a primary allegiance, either to labor or to capital or to the public rather than to all three. It is therefore recommended that labor should retain its own production engineers, and other technicians having scientific knowledge of the development of better ordered industry. Those seeking the public interest as well as those retained by the owners, will thus be in a position to counsel with well informed representatives of labor.

Theoretically this is sound reasoning, but in order to be practical and beneficial, it is vital that the engineers and experts retained by labor must themselves preserve the highest tradition of their class, namely, to maintain judicial impartiality and absolute justice and accuracy. It is very evident that such experts could not be members of the labor unions under their present constitutions, which require allegiance to the class interest above public interest or even public justice, restrict production and, in practice if not in specific letter, promote violence, intimidation and conspiracy.

More Outlaw Rail Strikes

About 600 yardmen in the employ of the Baltimore & Ohio and the Pennsylvania railroads struck in Baltimore June 20 without making demands on the railroads, without warning, and without giving any cause for their action. It is said, however, that the strikers are mostly under thirty years of age, and are directed by the leaders of the April strikes, and that the strike is not so much against the railroads as it is against the Railroad Labor Board because the latter has not completely granted all their demands as quickly as they desired. The strikers expressed their sympathy with the striking longshoremen and stevedores and say that with "The harbors closed and freight congestion, the demands of both will be met shortly."

This strike and that of the yardmen in the Philadelphia district on June 18th has crippled the movement of freight in both Philadelphia and Baltimore, and both of the railroad companies affected have placed embargoes in the local yards on all freight except perishables, live stock, food and fuel for public utilities.

Recent Legal Decisions

ORAL CHANGE IN TERMS OF WRITTEN EXCAVATION CONTRACT

A written contract was executed for certain excavating, grading, back-filling and concreting at fixed and definite prices per cubic yard. In an action for alleged balance due after the work was completed, the real question in dispute was the contractor's claim that the owner agreed that the unit prices named in the written contract should not be the measure of compensation for the work then or thereafter to be done, but that it should pay for the work and material the fair and reasonable value thereof. The Circuit Court of Appeals, Sixth Circuit, holds, United Steel Co. v. Casey, 262 Fed. 889, that a provision in the contract that no extras would be allowed without an understanding and written order did not prohibit the making of such an oral agreement, but was a fact to be considered by the jury. If the owner made changes in the location of the work, and failed to furnish plans for part of it, and underestimated the work of excavation, thus delaying the contractor in the performance of the contract and necessitating the doing a large portion of the work in the winter season, there was sufficient consideration for the oral contract changing the compensation, even though the owner did not specifically waive claims for damages from such delays. And if the owner misrepresented the character of the soil to be excavated, though the representations were made in good faith, that would constitute a sufficient consideration for the oral contract. Judgment for the plaintiff was therefore affirmed.

CONSTRUCTION OF CLAUSE AUTHORIZING SUSPENSION IN SEWER WORK CONTRACT

The New York Appellate Division holds, Johnson v. New York, 181 N. Y. Supp. 137, that under a contract for sewer work, providing that the president of the borough might suspend the work if he should deem it for the city's interest, without compensation, the president was not authorized to suspend because the city had no appropriation to pay for engineering and inspection which it was impliedly bound under the contract to furnish, since it could not be assumed that the clause was intended to authorize one of the parties to impose the result of its own default upon the other.

CONTRACTS SUITS AGAINST STATES FOR WORK ON PUBLIC BUILDINGS

The Kansas Supreme Court holds, Heman Const. Co. v. Capper, 182 Pac. 386, that where a construction company entered into a contract with the state for the erection of a building in connection with a state public school an action for a balance alleged to be due thereon, brought against the official board which acted for the state in the letting of the contract, namely, the board of administration of educational, charitable and correctional institutions, is a "suit against the state," and as such it is not maintainable in the absence of a positive and unequivocal statute permitting the state or its official board to be sued. The contractor must look alone to the fund provided by the legislature to pay for the building. A statute which confers power upon a state board to institute or defend any and all proceedings necessary to protect the interests of the state is not a waiver of the state's immunity from suits at the instigation of private parties seeking to subject the state and its official boards to money judgments.

ADOPTION OF UNSIGNED SUBCONTRACT

Parties may adopt a written contract, and thus make it as binding as though formally executed by both, without signing it; therefore the Nevada Supreme Court holds, U. S. Fidelity, etc., Co. v. Reno Electrical Works, 183 Pac. 386, that in an action by the subcontractor on a public building against the surety on the contractor's bond, brought after complete performance by the subcontractor, the fact that the written subcontract was not signed is no defense.

RIGHT OF MATERIALMEN UNDER CONTRACTOR'S SURETY BOND

In an action by a materialman who furnished material for the construction of sanitary sewers for the city against the contractor's surety, the South Dakota Supreme Court holds, Evans v. Howard Fire Brick Co., 173 N. W. 448, that a contractor building city sewers had the right for his own benefit to enter into a contract with the defendant surety under which the latter might obligate itself to pay labor and materialmen on the contractor's failure to pay them, and materialmen not named therein could accept the contract thus tendered by the insurer and become parties thereto with right of action in case of the contractor's default, and such contract would not be affected by the fact that it also indemnified the city against laborers' and materialmen's claims. Where a contractor has expressly agreed to pay all claims for labor and materials and his guarantor binds himself to pay for such labor and materials equally with the contractor, laborers and materialmen may adopt such guaranty and enforce it as if it were made directly to them.

COUNTY SUPERINTENDENT OF CONSTRUCTION AS WITNESS—COSTS WHERE CLAIM IS EXCESSIVE

In an action by a subcontractor for the amount claimed to be due from the principal contractor as well as an amount claimed for extras, the general contract being with a county for the construction of a courthouse, it was held, Weiffenbach v. Puget Sound Bridge & Dredging Co., Washington Supreme Court, 184 Pac. 321, that the superintendent of construction for the county was a competent witness as to the amount and reasonable value of the extras, even though his determination might not be conclusive. Where such an action is equitable in its nature and costs should be apportioned under equitable rules, the assessment of costs against the subcontractor was held warranted though he recovered a substantial amount, where his claim was grossly excessive, particularly where there was no dispute as to the amount actually recovered.

NEWS OF THE SOCIETIES

July 6-8.—CONFERENCE OF MAYORS AND OTHER CITY OFFICIALS OF THE STATE OF NEW YORK. Annual conference, Jamestown, N. Y. Secretary, William P. Capes, 25 Washington avenue, Albany, N. Y.

July 26 - 30.—INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS Annual convention, Toronto, Canada. Secretary, Stephen E. Hoey, Municipal Bldg., New York.

Aug. 30-Sept. 3.—AMERICAN PUBLIC HEALTH ASSOCIATION. San Francisco. Office of secretary.

Sept. 7-10.—NEW ENGLAND WATER WORKS ASSOCIATION. Annual convention, Holyoke, Mass. Secretary, Frank J. Gifford, 715 Tremont Temple, Boston, Mass.

Sept. 13-17.—AMERICAN PUBLIC HEALTH ASSOCIATION. Boston, Massachusetts.

Sept. 13-17.—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual convention, San Francisco, Cal.

Sept. .13 - 17..— SOUTHWESTERN WATER WORKS ASSOCIATION. Annual convention, St. Charles Hotel, New Orleans, La. Secretary, E. L. Fulkerson, Waco, Texas.

Sept. 20 - 23. — SOUTHWESTERN WATER WORKS ASSOCIATION. Annual convention, St. Charles Hotel, New Orleans, La. Secretary, E. L. Fulkerson, Waco, Texas.

Oct. 12-14.—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. St. Louis, Mo. Secretary, Charles Carroll Brown, 401 Lincoln Avenue, Valparaiso, Ind.

BUFFALO ENGINEERS IN CHAMBER OF COMMERCE

Buffalo engineers and architects have formed an auxiliary organization to co-operate with the Chamber of Commerce in the engineering and industrial development of Buffalo.

THE ENGINEERING SOCIETY OF WESTERN MASSACHUSETTS

Engineering Society of Western Massachusetts held its first annual meeting at Springfield, May 10, and elected C. D. Chesney, president.

CANTON ENGINEERS' CLUB

An engineers' club has been formed at Canton, Ohio, and has already enrolled more than a hundred members and has elected E. J. Landor of Nebraska as president and H. B. Waha, secretary.

TERMINAL ENGINEERS

The society of terminal engineers, New York City, in its recent election of officers for the coming year, has made president, John Meigs; vice-presidents, E. A. Lee, Calvin Tompkins, C. W. Baker, M. W. Williams and R. H. McLain; for secretary, J. H. Leonard, 20 Vesey street, New York.

THE WESTERN SOCIETY OF ENGINEERS

The practice of making occasional excursions to out-of-town points that has for several years been discontinued, was recently resumed by the Western Society of Engineers, who on May 28 visited the Forest Products Laboratory, the university of Wisconsin, State Capital and the Gisholt Machine Company at Madison, Wis.

THE STATE SANITARY ENGINEERS' ASSOCIATION

This association, organized last fall, met in Washington, D. C., May 23-27.

THE UTAH SOCIETY OF ENGINEERS

At the recent annual meeting there were elected the following officers: H. T. Plumb, president; Leroy M. Pharis and E. H. Beckstrand as vice-presidents; W. E. Turner, secretary, and R. K. Brown, treasurer.

AMERICAN ASSOCIATION OF ENGINEERS

The Washington Assembly of the A. A. E. was organized at Tacoma on May 22 by representatives of the Aberdeen, Bellingham, Everett, Olympia, Seattle, Spokane and Tacoma chapters. Representatives were also present from Anacortes, Chehalis and Walla Walla. It was decided to arrange for the Pacific Builder and Engineer as the official organ of the assembly.

E. T. Tannatt, of Tacoma, addressed the meeting on laws relative to county engineers. A committee was appointed to present at the next meeting suggestion for the revision of such laws. The next meeting will be held at Everett, Wash., on August 24.

The first annual meeting of the Nebraska Assembly of the A. A. E. was held in Lincoln, Neb., on May 29. There were elected: President, W. R. McKeen; first vice-president, Prof. Clark E. Mickey, Roy N. Toll, city commissioner, Omaha; treasurer, George W. Bates city engineer, Lincoln, Neb.; secretary, Watson Townsend, assistant engineer, U. P. R. R., Omaha.

At the June 16th meeting of the Indianapolis Chapter, the usual noon luncheon was served in the Chamber of Commerce Building and an address was made by Prof. C. F. arding of Purdue University recommending that the association cooperate with the American Federation of Engineers on a conservative platform. The resolution on open specifications was discussed and referred to the ethics committee.

From the national headquarters of the association, a circular letter has recently been sent to 93 deans of engineering colleges asking for comment on the proposed schedule of salaries recommended for educators and which varies from a minimum of $1,800 per year for an assistant instructor, to a maximum of $15,000 for the dean, director or superintendent reporting directly to the president of the institution.

LOUISIANA ENGINEERING SOCIETY

New Orleans, June 2, 1920.

At a regular meeting of the Society, held in the Lafayette Theatre, June 4, there was presented an illustrated lecture by Mr. W. M. White, manager of the hydraulic department of Allis-Chalmers Company.

NATIONAL ADVISORY HIGHWAY BOARD APPOINTED

The U. S. Secretary of Agriculture has appointed as members of the Advisory Highway Board: Paul D. Sargent, chief engineer, State Highway Commission, Augusta, Me.; Joseph Hyde Pratt, secretary, American Association of State Highway Officials, Chapel Hill, N. C.; George E. Johnson, state engineer, Department of Public Works, Lincoln, Neb.; W. G. Thompson, state highway engineer, Trenton, N. J.; Ira R. Browning, state road engineer, Salt Lake City, Utah; W. D. Uhler, chief engineer, State Highway Commission, Harrisburg, Pa.; C. J. Bennett, state highway commissioner, Hartford, Conn.; A. B. Fletcher, state highway engineer, Sacramento, Cal.; W. R. Neel, state highway engineer, Atlanta, Ga.; W. S. Keller, state highway engineer, Montgomery, Ala.; Geo. P. Coleman, state highway commissioner, Richmond, Va.; S. E. Bradt, superintendent of highways, Springfield, Ill.

At the first meeting, in Washington, D. C., June 4 and 5, the board discussed the general principles governing the formation of the national highway policy.

KENTUCKY GOOD ROADS ASSOCIATION AND KENTUCKY STATE ROAD ENGINEERS' ASSOCIATION

There was held in Louisville, Ky., on June 15th, 16th and 17th, a convention of Kentucky State Road Engineers, as well as the Kentucky Highway Association, County Judges, members of the Fiscal Courts of the State and all allied Good Road interests.

Coming at an opportune time when the new Kentucky Road Law is about to go into effect, under which there will be spent by the State Highway Department more than $4,000,000, it was one of the greatest Good Road meetings ever held in the State

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The Minnesota Joint Engineering Board has recommended the appointment of Francis C. Shenehon, consulting engineer, of Minneapolis, to the vacancy in the membership of the International Joint Commission.

THE FEDERATED AMERICAN ENGINEERING SOCIETY

The Federated American Engineering Societies, an organization to be composed of national, regional and local societies, was organized at Washington, D. C., June 3 and 4, to further public welfare wherever technical engineering and engineering experience are involved; and to consider and act upon matters of common concern to the engineering public and their allied professions.

The action taken by the representatives at the organizing conference must yet be ratified by the societies which sent delegates and applications for membership must be received and accepted to establish the Federation. Individual memberships are not now announced, although the constitution may be construed to include the admission of individuals. Funds will be provided by contributions from the member societies of $1.00 and $1.50 a year per member, from local societies and from national societies, respectively. These funds may not be used by the local organizations or by the state councils which are provided by the constitution.

Direction is by an American Engineering Council meeting annually, to which member societies will send delegates in proportion to their memberships. An executive board of thirty members is provided, meeting monthly, to direct activities throughout the year. The officers of the council consist of a president, four vice-presidents, a treasurer and an executive secretary.

AMERICAN SOCIETY OF CIVIL ENGINEERS

At the June 2nd meeting Charles Evan Fowler presented a paper on the Revision of the Niagara Railway Arch Bridge, illustrated by lantern slides. It described work accomplished in 1918-19, and included a complete investigation of live loads for railway bridges, strain-gauge studies and a new strain gauge, special toggle for jacking apart the top chords for the readjustment of stresses in members, unit stresses and a logical column formula, methods of reinforcing the floor system abutments, etc.

OKLAHOMA ENGINEERS' ASSOCIATION

A state association of members of the American Society of Civil Engineers has been organized for Oklahoma with H. B. Hinckley, president, and E. S. Alderman, C. M. Pritchard, E. M. Graham, F. D. Brown, H. F. Layton, and M. L. Cunningham as vice-president, and F. H. Craddock as secretary.

SAN FRANCISCO ENGINEERING ASSOCIATION

The San Francisco section of the American Society of Civil Engineers at the meeting of June 8, had a large attendance and papers on, The Causes of and Problems of Increased Salinity in San Pablo and Suisun Bays, on Teredo Attacks on Piles that have been immune for 50 years, and on What Increased Salinity Means to Irrigation and Water Systems, were presented and discussion on them was led by 12 members previously prepared to make four minute speeches.

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS

After a two-day meeting at the office of the Bureau of Public Roads, Washington, D. C., the executive committee of this association recommended the acceptance by the U. S. of the invitation to become a member of the permanent international association of road congresses and to invite the association to hold its next meeting in the United States.

The United States is now the only civilized country not a member of the international road congress and membership in it is strongly recommended by T. H. MacDonald, chief of the Bureau of Public Roads

GOOD ROADS CONGRESS

The seventh annual good roads congress at Winnipeg, Canada, was attended by more than 200 delegates including a large number from the United States and a strong sentiment was manifested for improved cooperation between educational, technical and civic bodies interested in highway construction and maintenance.

NATIONAL HIGHWAY TRAFFIC ASSOCIATION

The recently published proceedings of the annual convention, held last January, of the National Highway Traffic Association, the Highway Transport Conference, and the National Automobile Chamber of Commerce, contain considerable interesting and valuable data including the report of the committee on highway transportation franchises, on inter-relationship of highway, railway and waterway transyort, and papers on the effect of Car Tracks on Traffic Capacity of Roadways by Geo. W. Tillson, Taking an Interest in Motor-truck Legislation by Harry Meixell, Value of Highway Transport Surveys by F. Van G. Lane, Inter-relationship of Highway Transports and Back to the Farm Movement by S. B. Norton, Relation of Highways to Motor Truck Operating Cost by Arthur H. Blanchard, and Constructing Roads for Motor Truck Traffic by T. R. Agg.

The report is published by the National Automobile Chamber of Commerce, Inc., Marlin-Rockwell Bldg., Madison Avenue and 46th Street, New York City.

THE NEW JERSEY STATE ASSOCIATION OF COUNTY ENGINEERS

This association held its quarterly meeting at Hotel Mannahasset, Seaside Park, New Jersey, June 25 and 26. H. F. Harris, Secretary, Mercer County Court House, Trenton, N. J.

NATIONAL FEDERATION OF CONSTRUCTION INDUSTRIES

Pursuant to a call from the managing director of the federation, a meeting was held in Philadelphia, June 17, of construction associations to confer together and discuss the problems immediately confronting the industry with Ernest T. Trigg, president of the federation, and S. T. Miller, vice-president, who is serving as expert adviser to the senate special committee, which has the power of subpoena and is expected to call representatives of the construction associations into conference As the attitude and purpose of the senate special committee is wholly one of helpfulness and benefit to the construction industry and to the public, it was desired to afford every possible assistance to it. This preliminary group conference was therefore considered essential and to better serve the purpose than individual conferences in anticipation of the subpoenas.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

The 36th annual convention to be held at the Greenbrier, White Sulphur Springs, West Virginia, June 29-July 2, will include six business and technical sessions at which there are scheduled for presentation, 38 papers, including four on protective devices and 19 on electric welding and power factors.

The entertainment of the delegates is amply provided for by golf and tennis tournaments, baseball games, piano recital and dancing, informal reception, a ladies' bridge and tournament, and numerous automobile drives for large and small parties.

AMERICAN SOCIETY OF CIVIL ENGINEERS' CONVENTION

The 50th annual convention of the American Society of Civil Engineers will be held in Portland, Oregon, Aug. 10-12, under the direction of D. C. Henny, chairman, Chas. B. Marx and Herbert C. Crocker, committee of arrangement of the board of direction, and a local committee of 16 members headed by Geo. P. Mason, chairman.

The headquarters of the society and the secretary's office will be at the Multnomah Hotel which has facilities for the accommodation of all the delegates to the convention. Contrary to the precedents of many previous years, no special railroad rates are made for this convention, and the announcement circulars state that the traffic is so heavy this season that members are urged to make their reservations as early as possible The preliminary program announces the opening of the convention at 10 a. m. Tuesday, August 10, by the annual address of President Arthur P. Davis and an automobile ride to the ladies entertained by the Waverley County Club in the afternoon when there will also be a business meeting. In the evening there will be a reception by the local membership and on Wednesday, August 11, there will be in the morning an automobile trip over the Columbia Highway to Eagle Creek returning by boat in the afternoon in time for an evening smoker at the hotel.

Thursday the 12th may be devoted to a trip to one of the logging camps for the inspection of the modern large scale methods used in timber production in the northwest.

PROBLEMS THAT CITIES ARE STUDYING WITH EXPERTS

The Kansas City Engineers' Club has appointed F. W. Fratt, manager of the Eclipse Valve Company, as chairman of the Civic Sanitation Committee, which will first take up the problem of water supply.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

RANSOME NEW CONCRETE PAVER

Designs have been for some time substantially completed for the Ransome Concrete Machinery Company's new paving machine, that has been built and operated for a considerable time in order to permit continued observation and the modification of any details which it appeared could possibly be changed in order to give smoother or more convenient action or greater durability requisite for the most perfect machine that it is possible to construct for the required purposes.

A great deal of time and pains have therefore been spent in giving extra value to a machine intended to satisfy all requirements, under all conditions, and even to be superior to neglect and abuse so as to provide a reliable plant the year around for continuous or intermittent service even when handled by inexperienced operators, and to involve minimum expense for maintenance, repairs or renewals.

The machine, which weighs complete about 22,000 pounds, has a horizontal boom 20 feet long elevated about 6 feet above the ground, and exclusive of it, is 11½ feet long, 13 feet high over all and 9 feet wide when the detachable platforms are removed.

It has a capacity for 21 feet of mixed concrete that can be turned out well mixed at the rate of 1 batch in 1½ minutes or less. It is mounted on a very stiff steel frame with crawler traction enabling it to propel itself forward or back at the rate of ½ mile per hour. It is equipped with a standard 21 S. Ransome mixer drum and extra large bottom dump bucket designed to receive the concrete in the center of the bucket, which is an important feature for dry concrete.

The traverse of the bucket back and forth on the boom is controlled by a single lever and as soon as the bucket starts to move back towards the mixer a trigger commanding the links from the bottom flaps, is automatically operated to dump the contents of the bucket without requiring any attention except from the man who directs all the operations of the machine from a platform about 6 feet long. At one end of this platform are grouped the handle that controls the water tank discharge and the four levers that control the reverse gear and clutches for the tractor and the drums operating the charging hopper and a small swinging crane alongside that unloads the sand, gravel and cement if necessary and empties them into the hopper.

All of the principal journals have Hyatt roller bearings and all of the gears are enclosed for safety.

Although the maximum effort (when the charging hopper is being elevated) only requires 9 h.p. the machine is provided with a standard 14 h.p. engine specially balanced to avoid vibration and provided with sight oil cups and enclosed in a dust-proof case. Steam is produced in a 16 h.p. boiler and there is a 2½x6 foot cantilever platform available for fuel or water tanks, storage or other purposes.

The time of mix is controlled by a special meter that locks the discharge chute until the drum has made any fixed number of revolutions when it automatically unlocks the chute and rings a bell. Filling the drum resets the meter for the next batch.

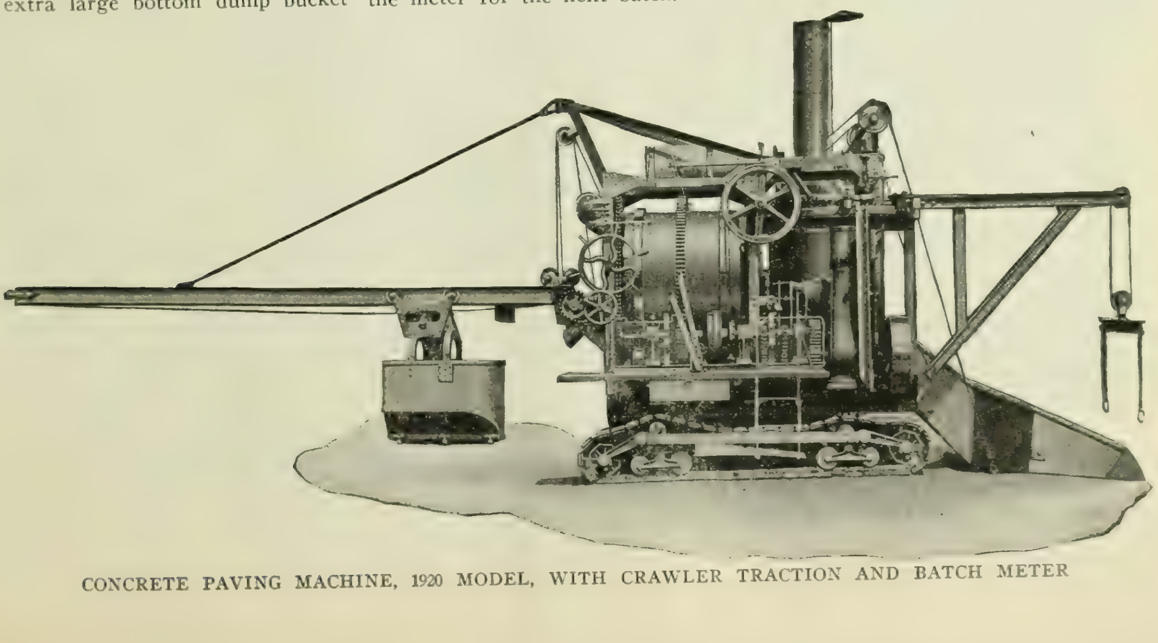
At the opposite end of the operator's platform there are located one lever for loading the mixer, one lever to start and stop the drum, a wheel for discharging the mixer into the bucket, and a lever to control the movement of the bucket on the boom which is so easy that the empty bucket has been blown back and forth by the wind.

Canvas curtains provide a neat and attractive roof and windshield over the operator's platform. They are attached to a light steel framework and adjusted to give an unrestricted opening or such protection as he may desire from sun, wind and rain.

PATTERSON MIXING MACHINE

The Paterson type "E" mixer manufactured by the Paterson Foundry & Machine Company has a wide range of usefulness and is claimed to be almost indispensable for mixing liquid chemicals, rubber, paint, varnish, glue, oils, and clay, and is built in several sizes both plain and with steam jackets

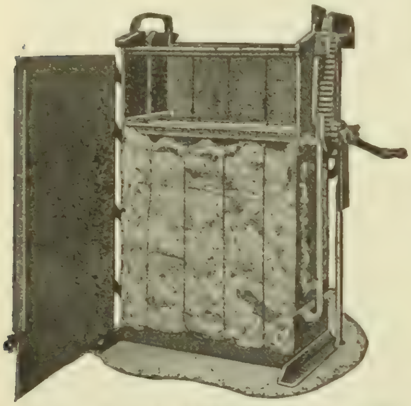
They ordinarily have a tight cylindrical steel tank of rigid construction with heavy stirring mechanism mounted on top and provided with suitable stirrers which, in sizes 0 and 1, are of cast iron and in the larger sizes are of steel. They can be furnished with wooden or cast iron tanks and with duplex mixing devices rotating in opposite directions. The standard sizes of plain mixers have tanks 15 to 72 inches in diameter with capacities of 11 to 1269 gallons. The jacketed mixers are made with diameters of 24 to 72 inches and capacities of 47 to 1269 gallons.



CONCRETE PAVING MACHINE, 1920 MODEL, WITH CRAWLER TRACTION AND BATCH METER

HAND POWER BALING PRESSES

The Famous Manufacturing Company is the maker of portable hand power presses for baling various bulky materials and has put on the market several styles and sizes specially adapted for waste paper and for sheet metal scraps. The former is made in six sizes, weighing from 150 to 550 pounds, and producing a bale from 150 to 350 pounds. It is made of sheet steel and the plunger is driven by a rack and pinion actuated by a ratchet lever that can be operated by a boy.



HAND POWER PRESS FOR BALING PAPER, RAGS, ETC.

The sheet metal scrap busheling press is power driven, weighs 3,500 pounds, and occupies a 5 x 8 foot floor space. The plunger is operated by a double-geared toggle driven by a heavy fly wheel. The scrap is shoveled into the hopper, the lid closed, and in 10 seconds all kinds of sheet metal scraps, shear trimmings, metal chips, punching wire, tin cans, and other sorts of scrap are compacted into a 15 x 15 x 15 inch bale weighing from 30 to 60 pounds. The machine is operated by about 5 h.p., and with one man can turn out from 3 to 5 tons product per day and with two men from 10 to 12 tons daily.

POWER DRIVEN BUSHELING MACHINE FOR SHEET AND SCRAP METAL

INDUSTRIAL NOTES

The city of Chattanooga has purchased from the Kinney Manufacturing Company a standard 800-gallon Kinney Auto Heater and Distributor, and mounted on a separate sub frame and interchangeable with the oiler equipment on the same truck chassis, a 1,000-gallon tank with bronze lined pump, flusher nozzles and sprinkler heads. This combined equipment cost $5,000 over the cost of complete units for this class of work, and is considered a worth while combination for many cities which do not have enough hauling work to keep this equipment busy a large part of the summer.

LOCK JOINT CONCRETE PIPE CO.

Lock Joint Pipe Co. is constructing 10 miles of 54-in. water pipe for the City of Denver, and they also are constructinn 8,000 feet of 48-in. reinforced concrete pipe (pressure) for the City of Kansas City, Mo., in both cases building the pipe at the site of the work.

The Lock Joint Pipe Co. is at present operation plants in the following states: New York, New Jersey, Pennsylvania, Virginia, Louisiana, Missouri, Kansas, Oklahoma, Colorado, Utah, Montana and Ontario, Canada, these operations covering construction that cannot be handled from the head manufacturing plant at Ampere, N. J

KENNEDY VALVE MFG. CO.

The Kennedy Valve Manufacturing Company of Elmira, New York, announces the removal of its New York office and warehouse to 95 John street and advises its patrons that there will be kept there in stock large quantities of the most popular sizes and types of Kennedy valves ready for immediate delivery.

The company also announces that J. S Hanlon will be the New York representative, and that C. H. Kennedy has been made the general sales-manager.

AMERICAN PLANT ABROAD

In order to maintain sufficient depth of water in the Whangpoo River at Shanghai where there is a vast amount of commercial navigation, the Standard Oil Company has installed there a dredge equipped with a clamshell bucket operated by an 80-foot derrick boom and an American hoisting engine. When not employed in dredging, the steel barge and derrick are available for handling freight.

PERSONALS

Stillwell, Howard, has been appointed city manager of Sumter, S. C.

Bien, Morris, has been appointed assistant director of the U. S. Reclamation Service.

Williams, J. D., has been appointed city engineer of New Britain, Conn.

Hilscher, Ralph, has been appointed director of the Bureau of Sanitary Engineering of the California State Board of Health.

Richan, G. F., has been appointed junior hydraulic engineer of the Canadian Reclamation Service.

Green, Roy M., professor of highway engineering at the Agricultural and Mechanical College of Texas, has resigned that to become president and manager of the Western Laboratories at Lincoln, Nebraska. Western Laboratories will take over the consulting and testing practice of Clark E. Mickey, of Lincoln, Neb., and will specialize in the testing and inspection of all kinds of building materials and operations.

The Kansas City Engineers' Club has appointed F. W. Fratt, manager of the Eclipse Valve Company, as chairman of the Civic Sanitation Committee, which will first take up the problem of water supply.

Van Duyne, J. R., since 1912 division engineer of the Passaic Valley Sewerage Commission, has been promoted to chief engineer of construction at a salary of $6,000, succeeding the late William M. Brown, recently deceased.

Easter, J. B., has been appointed district engineer of the 6th State Road District of New Mexico.

Moorfield, Chas. M., has been appointed chief engineer of the South Carolina State Hwy. Department.

Gabriels, Henry E., has been appointed city manager of Watervliet, N. Y.

Spelman, J. R., has been appointed assistant consulting and resident engineer for the preparation of plans, specifications and supervision of construction for the Long Beach bridge, Nassau County, N. Y.

Macksey, H. V., has been appointed superintendent of public works, Framingham, Mass.

Miller, F. F., has been appointed city engineer, New Castle, Pa.

Lynt, R. K., has been assigned to service on topographic mapping of Admiralty Island for the U. S. Geographical Survey.

Gray, B. E., has been appointed senior highway engineer of West Virginia.

Wells, Wm., has been appointed to investigate the water supply of Rensselaer, N. Y.

Mackie, G. D., has been appointed to represent the city of Moose Jaw, Sask., on the Saskatchewan Water Supply Advisory Council.

O'Dell, DeWitt, has been appointed assistant engineer in the State Engineer's Department, Rochester, N. Y.

Kyle, C. K., has been appointed comptroller of the Pennsylvania State Highway Department.

Custance, A. M., resident engineer of the Massachusetts State Highway Commission, has been appointed superintendent of water, streets and sewers, Hudson, Mass.

Flory, Samuel, founder and general manager of the S. Flory Manufacturing Co., died recently at Bangor, Pa.

Parmer, Claude, vice-president of the Kuert Contracting Co, died recently in Indianapolis.

GOETHALS, WELLS & CO.

The general engineering and construction firm of Goethals, Wells & Co., 150 Nassau St., New York, has been formed, with Major-General G. W. Goethals, president, George M. Wells, Henry Goldmark and James L. Ward, vice-presidents. The firm will specialize in engineering and architectural design and construction.

PUBLIC WORKS.

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL AND PUBLIC WORKS" and "CONTRACTING"

Vol. 49 FLORAL PARK, JULY 10, 1920 No. 2

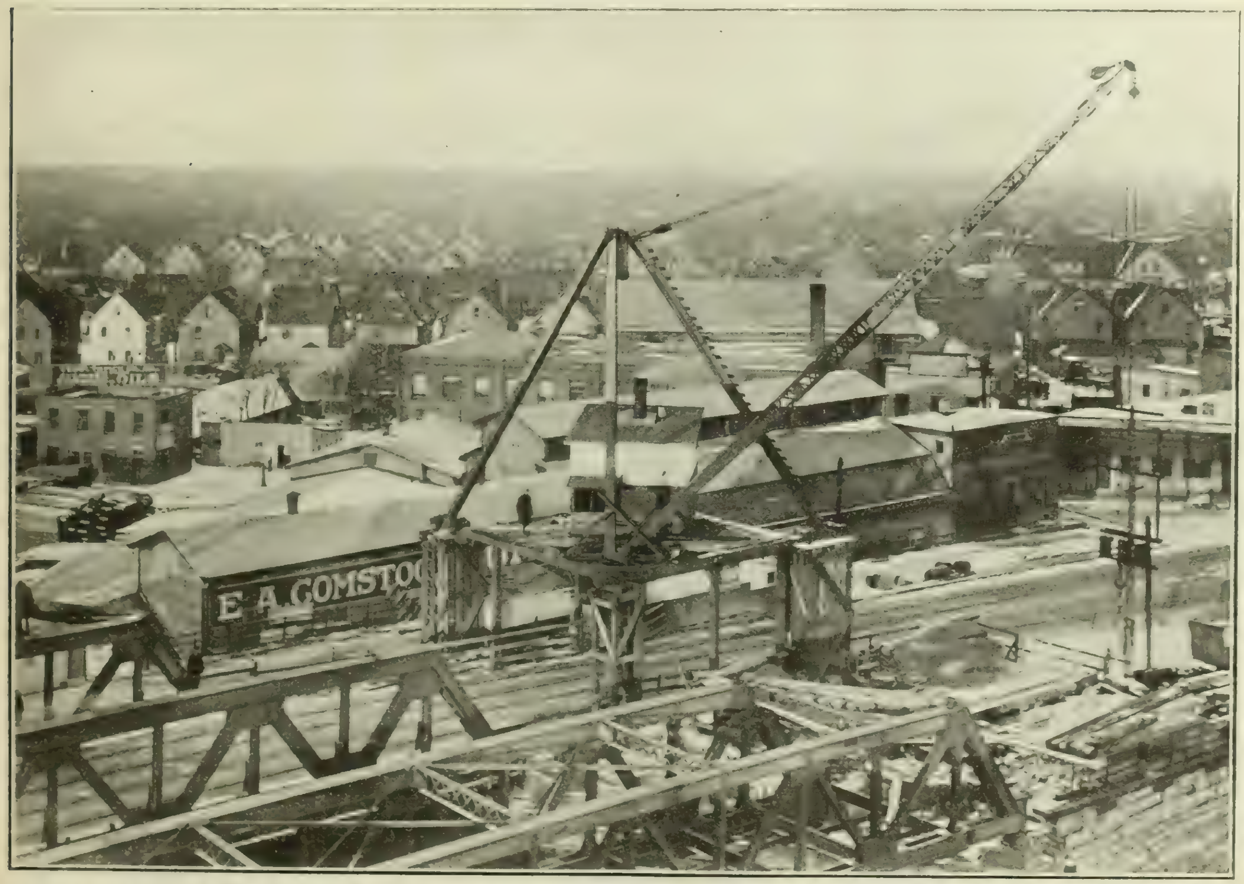
Reconstructing East Main Street Bridge, Rochester

Reconstructing wide, short-span city bridge over railroad tracks under difficulties, without interrupting traffic. New trusses temporarily supported by old ones and vice versa. Steel unloaded and erected by stiffleg derricks on abutments

A municipal bridge, built in about 1890 by the Rochester Bridge Company, carried two electric car tracks, two roadways and two sidewalks over four main tracks and two yard tracks of the New York Central Railroad, where they intersect Main street, Rochester, New York.

The superstructure which contained about 380 tons of steel, was 115 feet long and 86 feet wide overall, with a clearance of only 16½ feet above the base of rails in the tracks below.

The bridge was skewed 53 degrees 33 minutes with the railroad tracks and had five double-intersection, riveted latticed girder trusses 20 feet deep carrying a buckle-plate floor.



ROADWAY CARRIED BY NEW TRUSSES. STEEL DERRICK IN POSITION CLEARING TROLLEY TRACKS

After the bridge had been several years in service, the floorbeams were trussed with bent screw-end rods and were enclosed in protecting concrete, which strengthened them so much that they still carried the heavy loads although, when removed in 1915, some of the steel webs were corroded completely through. Above the floor, the trusses were in excellent condition. The masonry abutments and foundations were sound and satisfactory, and were utilized for the new superstructure after cutting them down to an elevation 9 feet below the original bridge seats and re-building the upper parts with concrete suited to the entirely different bridge seats for the new trusses.

The new structure has five lines of latticed girder trusses 115 feet long and 12½ feet deep overall, which support Bethlehem rolled girder beams 24 inches deep and beam stringers. These carry a flat slab, reinforced concrete floor continuous over entire structure which protects all of the steel work from the fumes of locomotives passing below, which had greatly damaged the floor of the original structure. The new steelwork, weighing about 470 tons, was designed by the engineering staff of the New York Central R.R., fabricated at Fort Pitt Bridge Works and erected by the Terry & Tench Company, New York, J. S. Peck, superintendent in charge. The work was done on a cost-plus-fee basis at a preliminary estimate of $62,000.

DELIVERY OF MATERIALS

Sand, broken stone and cement were delivered at the site on the low-level railroad tracks. The cement was stored in a water-proof shed adjacent to the bridge, which had a capacity of one carload. Sand and broken stone were received in open-top cars, shoveled by hand into wooden scale pans, hoisted by the erection derricks and dumped in small storage piles at highway grade close to the bridge.

The steel was delivered by rail to a storage yard about 1½ miles distant, and was hauled to the bridge site as required, loaded on a special truck drawn by four horses which, although the loads were comparatively light, were required to haul it up the heavy grade and to drag the truck through the soft soil at the storage yard.

The truck consisted of two ordinary, heavy, four-wheel wagons, each provided with a turntable bearing for the heavy pieces of steel, and connected at any convenient distance apart up to 25 feet or more, by a long wooden reach pivoted to both trucks. The tongue of the rear wagon was ordinary lashed to the reach, but when corners were turned it was unlashed and swung by hand to steer the wagon around the curve. This arrangement worked very well and was used for hauling a single heavy piece or several smaller pieces at a load; but on account of the absence of any storage place at the bridge site, the steel had to be lifted directly from the truck to position in the bridge and delays were necessary while the truck was gone for another load.

LOCATION OF OLD AND NEW TRUSSES

In the old structure the intermediate and outside trusses were spaced 18 feet and 25 feet respectively from the centre line of the centre truss, but in the new structure the centre and outside trusses remained in the same alignment, but the intermediate trusses were shifted 1½ feet farther from the centre, increasing the width of the roadway from 25 to 26½ feet, and reducing that of the sidewalk from 18 feet to 16½ feet.

The axis of the bridge is approximately north and south, and all of the new trusses were erected about 4 feet farther north than their final positions, with the north ends resting on crib work just back of the abutment wall and with the south ends resting on falsework bents set close to the face of the abutment wall, where there was clearance with the yard track.

PRELIMINARY WORK

Operations were commenced by diverting the traffic to the east roadway and sidewalk and removing the floor on the west roadway and sidewalk to give access to the old lower chords and floorbeams. The very hard concrete that encased these members was laboriously removed with bull points and jack-hammer drills, the latter operated by the contractor's compressed air plant.

The tops of the old abutments were cut away where accessible and replaced by concrete built up piecemeal as fast as the old masonry was exposed and removed. The new trusses were all assembled at an elevation about 2 feet higher than their final positions.

The west intermediate truss was first erected just clear of the old centre truss on the west side. The lower chord, in 3 pieces, was supported as already mentioned at the ends and at intermediate points was carried on blocking from the old floor beams.

DERRICK SERVICE

The centre section of the bottom chord, 33 feet long overall, weighed about 14 tons and was unloaded from the truck and put in position by the two erection derricks operating together. For this service there were installed two derricks with wooden stifflegs and sills with 80-foot booms of 12 tons capacity at a radius of 70 feet. The derricks were located in the middle of the street with their masts nearly in the axis of the bridge, and about 5 feet clear of each end of the centre truss.

To avoid obstructing the roadway, the sills of each derrick were supported on three wooden falsework towers, as shown in the illustration, providing a clearance of 16 feet over traffic. The towers under the feet of the stifflegs were enclosed and filled with paving stones to provide suitable counterweights. One of the derricks had a steel boom and the other a wooden boom, both of the same length and same nominal capacity and both equipped with bull wheels and operated by two double-drum, double-spool, steam hoisting engines located on a platform built on the derrick sills.

All of the concrete materials were unloaded by one of these derricks, which had a reach just sufficient to enable it to serve the cars on the yard track and deposit the materials at one end of the bridge. When it was necessary to deposit the materials at the other end of the bridge, this derrick delivered its load to the second derrick, which swung them to final position. One of the derricks was tested with the 14-ton middle section of the bottom chord of the centre truss. When it slowly lifted the latter, it just overbalanced the counterweights so that the stifflegs commenced to rise, and the load was lowered back to the ground and afterwards was handled by both derricks together. Both derricks were equipped with seven-part topping lift wire rope tackles and five-part wire rope hoisting tackles, and connections to the heavy steel pieces were invariably made with wire rope slings, the ordinary hooks and clamps being used only for anchoring the derrick booms at night.

ERECTING NEW STEEL

For convenience, the trusses were lettered A, B, C, D, E, from west to east. Truss D was first erected in its first temporary position, riveted up and the temporary connections to the old floor beams were made. The old west floor plate was then removed and the trusses A., B., and C., were erected by blocking from the old floor beams, in their temporary positions.

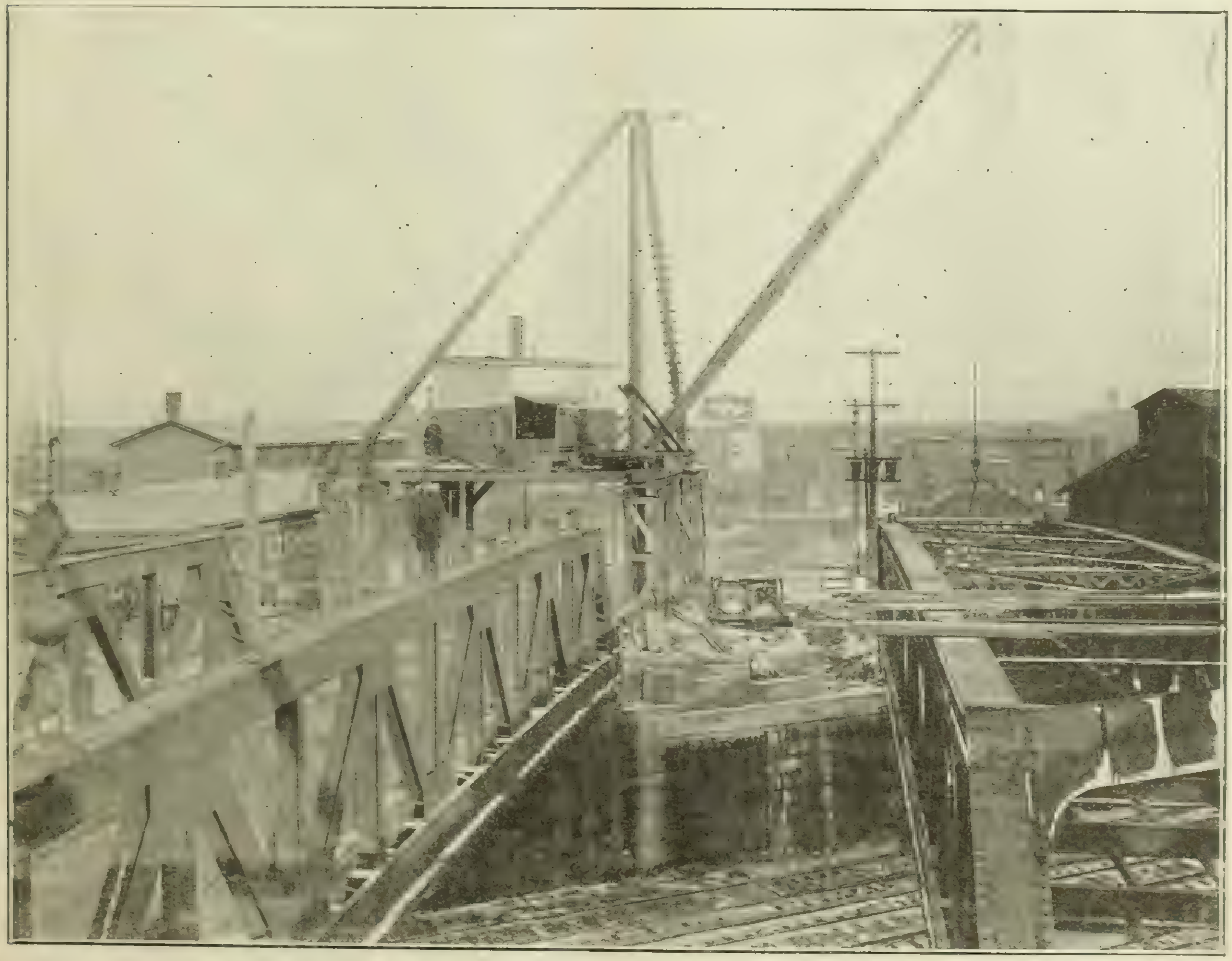
Trusses A., and B., were spaced 16½ feet apart centers, and about four floor beams and top laterals were bolted in place to provide against overturning. Truss C. was braced to truss B. by timber struts and wire lashings. Truss D. was braced to the old truss D. by using the old top lateral braces, bolted to the top chord.

Erection in all cases was started from the fixed end at the north abutment and continued across to the expansion end, the bottom chord being assembled first and then the web members and the top chord. The field joints of the trusses were then riveted up by pneumatic hammers and the camber blocks knocked out.

SUPPORTING OLD STRUCTURE

After the encasing concrete had been removed from the ends of the old floorbeams pairs of vertical angle brackets were riveted to their webs. These brackets were bolted to the flattened lower ends of a pair of vertical 1½ inch screw rods with nuts at the upper ends, that took bearing on saddles supported by pairs of lateral 12x12 inch beams supported on the top chords of the new trusses. The nuts were screwed up to take the weight of the old floorbeams and lower loads, and the floorbeam connections to the old trusses were cut away. The old trusses themselves were lashed, at and between panel points, to the adjacent new trusses, and the old floor and old trusses were separately removed at convenience.

The truss members were cut off with oxy-acetylene flames close to the panel points, allowing the web members and chords to be removed in good-size sections. There was danger that the melted steel dropping from the torches would set fire to trains passing under the bridge, so that it was necessary to suspend torch operations whenever a train was underneath and two flagmen were kept on constant duty below the bridge, during working hours, to signal approaching and departing trains, thus interrupting the work not only during the passage of the trains, but afterwards during the time it was



NEW TRUSSES ALL ERECTED, PART OF FLOOR CONCRETED. WOODEN DERRICK ASSEMBLING BRACES necessary to start a torch and heat the steel up to the melting point again. Notwithstanding these delays, the work progressed so rapidly that a truss could be cut to pieces and removed in about 2 days.

SHIFTING NEW TRUSSES

After the old centre and west side trusses had been removed, a 60 ton hydraulic jack was placed under each end of each new truss and they were raised slightly to permit the insertion under them of track plates made of pieces of old top-flange coverplates removed for the purpose. Between the top and bottom track plates, there were inserted, at each truss, about a dozen small rollers made from short lengths cut from the 1 inch diagonal rods of the old trusses.

The trusses were lowered to bearing on these rollers and were pulled transversely about 3 feet by two steamboat ratchets attached to lines anchored beyond the bridge. The trusses were easily moved, and, after reaching their proper alignment, were again jacked up, the rollers turned 90 degrees and then moved longitudinally about 4 feet to the required position by a single steamboat ratchet for each truss. The trusses were then lowered to bearing in their final positions on the new concrete seats.

Truss C. was braced to truss D. and trusses A. and B. were moved as a unit. Truss C. was then moved to position by itself, being tied to truss B. and truss D. by tackles to prevent overturning. The floor beams and stringers were then assembled and riveted and the floor poured as stated.

When traffic was shifted to the new west roadway, the east floor was removed and truss E. erected in its temporary position. Truss D. was then moved from is first to its second temporary position, a distance of about 25 feet. This was the most critical point of the job, for the danger of overturning the truss was greater than on the shorter moves on the west side. The truss was braced by three sets of tackles to the new truss C. and the old truss D. The moving was done in the same manner as on the other side, great care being taken to keep the truss plumb at all times.

The truss was moved to its second temporary position, i.e. 16 feet 6 inches from truss E. in a day and a half. Several floor beams and top laterals were then bolted in place, as on the west side, and trusses D. and E. were then moved to their final position as a unit. This final move took about two days.

This moving of the trusses could not be done, of course, until the old trusses had been removed and the abutments remodeled.

FLOOR CONSTRUCTION AND PROTECTION

After floorbeams and stringers had been erected and riveted in position concrete forms were suspended from them, floor reinforcement was placed as required, and the floor slab was poured with concrete mixed in a Ransome "Bantam" machine installed near the abutment in the abandoned portion of the street and delivering to wheel carts that dumped the concrete directly into the form.s

After the concrete floor slab was 21 days old, traffic was shifted from the east to the new west roadway and sidewalk, and the east side of the old structure was replaced in substantially the same manner as the west side already desscribed.

The passage of trains underneath the bridge was a very disagreeable feature of the erection, especially since a feud developed between the roughnecks and the locomotive drivers and the latter took pleasure in blowing the high pressure blast, which, emerging from the smokestacks only 6 inches below the working scaffolds,struck them with such force as to frequently lift the scaffold boards several inches and of course filled the air with hot cinders and noxious gases, much to the discomfort of the bridge erectors, who responded by accidentally dropping various materials on the passing trains. The blast was so strong that it was necessary to always tie the scaffold planks firmly to their supports.

To protect the new structure from the locomotive blast, the under side of the concrete floor slab was covered, on the centre line of each of the six tracks, by a series of cast-iron plates, about 3 feet wide and in 6 or 8 foot sections, extending from end to end of the bridge.

These plates are provided on the upper sides with pairs of vertical lugs that match bent plates engaging the bottom flanges of the structure and forming corresponding lugs which like those on the plates are perforated with holes for pins that pass through both, and lock the lugs to the stringers thus supporting them in close contact with the concrete that is flush with the upper surface of the cast iron plates.

The pins pass through gas pipe sleeves provided to enable the former to be removed and the cast iron plates to be replaced, if necessary, without interfering with the concrete. As these plates were rather large and heavy and had to be placed under the bridge floor in the very narrow clearance over the tops of the trains, their erection was rather difficult and it was necessary to lower them by a sling attached to one end, then attach another sling to the other end and hoist them up into horizontal position and adjust them with some difficulty while the holes were made to register and the pins were driven through the pairs of lugs.

UNFAVORABLE COST CONDITIONS

During the erection of the bridge, which was commenced in April 1919, disagreements occurred between the labor unions, the local contractors, and the railroad company with which the bridge contractors were not identified but which seriously delayed the work and increased the scale of prices from $0.90 up to $1.25 per hour for Ironworkers, and from $0.55 to $0.65 per hour for common labor. These interruptions, the difficulty of getting materials, and other troubles greatly increased the estimated time for construction and the work is still in progress, although the erection has been completed and it only needs a few weeks time to finish the concreting of the east half of the floor and complete the contract. Except during the month of February and March last, the work has been constantly in progress since its beginning, with an average force of about 60 men, and has cost to date more than $100,000, which is a very excessive price for rebuilding the superstructure only of one short span which under favorable conditions, should have been much more quickly and cheaply erected. As it is, both the contractor and the railroad company have done everything possible to secure rapid and excellent work at the lowest possible cost.

Mud Holes and Road Drainage

The following, from the *Service Bulletin*, the monthly bulletin of the Iowa State Highway Commission, will apply equally well to a greater or less number of roads in almost every other state:

"The weather and road conditions of this season demonstrated more conclusively than for years before in Iowa that drainage is the most important thing in road building. It is not sufficient to provide side ditches for surface drainage only. The great amount of water in the soil this season has caused springy spots in road grades that had not broken through for years to soften up and turn into veritable quagmires. In such cases nothing short of tile of ample proportion in the road grade itself and sufficient lines of them can be expected to do any permanent good. There are spots where double lines of tile, one on each side of the road, have failed utterly to drain the grade sufficiently to allow the road surface to carry its traffic. The one rule to follow as to the necessity for tile drainage within the road grade lines should be when in doubt use tile and plenty of it."

Perhaps not many states, however, have adopted the same temporary remedy for mud holes:

"It has been years since Iowa has had as many plank roads as she has today. Probably very few counties have gotten this far through the year without having mud holes which it has been utterly impossible to make passable without laying board paths for the car wheels. In the immediate vicinity of Ames on two of the main roads where drainage has been taken care of in the ordinary fashion with side ditches and which for several seasons have given no trouble, it has been necessary to bridge over the spots with plank pathways. Sleepers were laid upon the mud and upon these two lines of 2x12 boards, two planks wide, making a path two feet wide for each side, were laid. The most extensive road of this kind so far reported comes from Marshall county, where the stretch of bottom road south and west of Lamoille was planked for several hundred feet. Planking road in Iowa today seems like a rather primitive way of road maintenance but it was probably the only method possible for making some stretches of road passable for cars."

Comparative Value of Timber Cut From Live and Dead Trees

Prejudice exists in certain quarters against the use of timber cut from dead trees, and some purchase specifications insist that only timber cut from live trees will be acceptable. This prejudice is unjustified, in the opinion of the Forest Products Laboratory of the United States Forest Service. The laboratory officials make the following statement on this point:

As a matter of fact, when sound, dead trees are sawed into lumber and the weathered or charred outside is cut away, there is no method known to the Forest Products Laboratory by which the lumber can be distinguished from that cut from live trees, except that the lumber from dead trees may be partly seasoned when sawed.

All the information available at the laboratory indicates that timber cut from insect or fire-killed trees is just as good for any structural purpose as that cut from live trees of similar quality, providing the wood has not been subsequently injured by decay or further insect attack. If a tree stands on the stump too long after it has been killed, the sapwood is likely to become decayed or badly infested by wood-boring insects; and in time the heart-wood also will be similarly affected. The same thing is true of logs cut from live trees and not properly cared for. Until the wood becomes affected by these destructive agents, dead-tree wood should be just as strong and just as durable as sound, live-tree wood.

In considering the subject, it may be useful to remember that the heartwood of a living tree is entirely dead, and in the sapwood only a comparatively few cells are living. Most of the wood cut from trees is dead, therefore, regardless of whether the tree itself is living or not. Such being the case, purchase specifications, instead of providing that material must not be from dead trees, should state that material showing evidence of decay or insect infestation exceeding a specified limit will not be accepted.

County Takes Highway Contract

On June 1 Hamilton County, Tenn., through its County Judge and Highway Commission, signed a contract to build 10,143 miles of concrete road. The contract price was $340,000. This contract is for a part of the Chattanooga-Dayton Highway. The concrete is to be 16 feet wide, in addition to which there will be chert shoulders. The county has already contracted for the necessary machinery.

County Engineer Merrill will have direct supervision of the work. He has contracted for 37,000 barrels of cement, 15,000 cubic yards of gravel, 10,000 cubic yards of sand, $2,000 worth of iron pipe, a mixer costing $6,650, and a pump costing $1,650. He expects to use, for carrying the aggregate, a number of motor trucks which have their bodies divided into four compartments, each containing material for one batch. Other labor-saving devices will be used, so that it is believed not more than 50 men will be employed on the work. We are indebted for this information to the Chairman of the Hamilton County Board of Highway Commissioners, P. H. Thach.

Water Meters In Detroit

On July 1, 1916, there were in Detroit 46,991 meters in service, and on July 1, 1919, the number had been increased to 127,192, making 96.16 per cent of all used services metered.

In this connection it is interesting to learn from the latest annual report of the Board of Water Commissioners that, for the year beginning July 1, 1916, the total amount of water pumped into the distribution system was 52,040,254,250 gallons, while during the year ending June 30, 1919, in spite of the increase in population, the amount pumped had fallen to 48,716,817,350.

Of the total number of meters at the latest report, 119,088 were ⅝-in. or ¾-in. meters. These were of ten different makes, although only five of them were represented by more than 1,000 meters each.

Figures for the cost of repairing meters damaged by hot water during the latest fiscal year show that 4,143 were so damaged and that the repairing of them cost $1,011 for material and $8,020 for labor. For ⅝-in. meters the average cost for labor was $1.85 and for material was 20 cents. During the same year 1,587 meters were repaired because of damage by frost and 4,936 because of general wear and tear. The cost of repairing these meters averaged $1.62 for labor and 20 cents for material.

During the year the cost of installing ⅝-in. meters averaged $7.05, of which $6.70 was for material and 35 cents for labor and carting. During the year 35,954 ⅝-in. meters were tested at an average cost of 6 cents per meter. In addition, 7,151 larger meters were tested at costs up to $3.80 for an 8-in. meter.

East Hartford Waterworks Extension

Design and construction of supplementary plant increasing supply from 1,750,000 gallons to nearly 3,000,000 gallons per day by building two covered settling basins, low diversion dam, chlorinating devices and 6.2 miles of 16-inch supply main, thus providing a nearly automatic service for a population of 25,000 for about $320,000 contract price.

The East Hartford Fire District is an independent municipality with a present population of about 9,000, which is located on the opposite bank of the Connecticut river and about two miles from the city of Hartford. It has a separate high-pressure gravity system water supply, the first part of which was built about 1890 and derived about 500,000 gallons per day from the 1,500,000 gallons estimated run-off of the 1.37-square-mile watershed of the east branch of Salmon brook. As this brook furnished a continuously adequate supply, no storage reservoir was provided, and the water was taken from above a small diversion dam and carried in a 14-inch main through the town of Glastonbury, which it also supplied, to East Hartford, through a system of about 45 miles of supply and distributing mains.

This supply sufficed until about 1910, when the fire district acquired the north branch of Salmon brook with a watershed of 2½ square miles, a supply from which was connected to the old main by a 12-inch pipe running into a distributing well near the east branch, where a small settling basin was provided. No storage reservoir was built because it was the policy to acquire stream rights first, and to use the run-off of streams as long as it was abundantly adequate.

In 1914 the supply had been extended to serve a considerable number of mills and manufacturers and began to be inadequate for the requirement of 1,750,000 gallons per day. Attempts were made therefore to acquire additional supply from Cold brook, the south branch of Roaring brook, which is located four miles south of Salmon brook in the town of Glastonbury. To secure these rights, it was found necessary to appeal to the court for the condemnation of some of the property of four principal mill owners; two of whom agreed on the compensation while the other two refused, so that litigation was necessary and the rights were finally secured at a total cost for purchase expenses and litigation of about $80,000.

The system and its extension had for several years been in charge of C. Henry Olmsted, now city engineer of East Hartford, and when the Cold brook extension was contemplated, J. H. Fuertes, consulting engineer, New York, was retained and since that time has been associated with Mr. Olmsted in the extension of the system, took part in the condemnation proceedings, and prepared the plans and specifications for the additional plant which is now under construction.

GOVERNING CONSIDERATIONS

As the stream flow of Salmon brook and Cold brook combined will suffice without storage to supply the requirements of East Hartford and its dependencies for several years, not only was the provision of a storage system unnecessary but its operation, impounding the running water for a considerable period, would so change the character of the water that some form of treatment for it would be required to prevent the development of objectionable odor or taste that might appear if the water was impounded in the shallow storage that would be more available and less costly than storage deep enough to prevent these changes. At present, with proper precautions regarding contamination, such treatment is not required and it was possible to design and construct a simple and efficient system, at minimum cost, which for several years will provide adequately for the requirements of the city with very small operating charges.

The present plans, therefore, provide for taking the water directly into the diversion works, and distribution system, and are so developed that muddy water (following storms) and water that may be temporarily objectionable on account of disagreeable odor or taste, can be by-passed and the reservoirs washed out. The brooks clear up very rapidly after a storm and as they are not necessarily both muddy simultaneously, a limited storage suffices to supply the city during the 24-hour intervals in which it may be desirable to waste the flow from the brooks, and this amount of emergency supply is provided by the small receiving reservoirs at the heads of the mains.

Although the reservoirs are at different elevations, both are used for the supply through the same old mains, and are connected through a 12-inch Ross automatic reducing valve which reduces the pressure from the high level reservoir a few pounds—sufficient to prevent the possibility of the water from this reservoir overflowing through the low level reservoir during the night, when the attendant is not present.

AUTOMATIC CONTROL OF CHLORINATION

In order to remove any possible contamination of the water, chlorination is automatically effected at each reservoir and is controlled by the rate of flow, into each reservoir, of the supply water through a 10½-inch diameter orifice, at which sufficient difference of level will be produced on opposite sides of the orifice plate to operate the differential apparatus that regulates the dosage of chlorine; a requirement that is made necessary by the very wide variation between the amount of water consumed at hours of maximum draft and that consumed at hours of minimum draft, for without such provisions, the water would either be too much chlorinated when the draft is small or too little chlorinated when it is great. This enables the water to be used without the intermediate storage time which, if long enough continued, would act through natural operations to eliminate bacteria entering the storage.

RESERVOIR ROOFS

The reservoirs are covered to avoid the formation of ice, to exclude sunlight, and to maintain a more even temperature, giving cooler water in summer. The flat slab roof was adopted because the bottom of the reservoir is in compressible material, where the settlement of columns supporting groined arches might have a serious effect. The flat slabs give a satisfactory and substantial structure and are cheaply and quickly constructed.

It is believed that the system as now constructed will afford an excellent and reliable water supply for a minimum cost of construction until the present population is doubled, and that there will be involved no additional cost over the present expense of operation.

PRESENT AND FUTURE SUPPLY

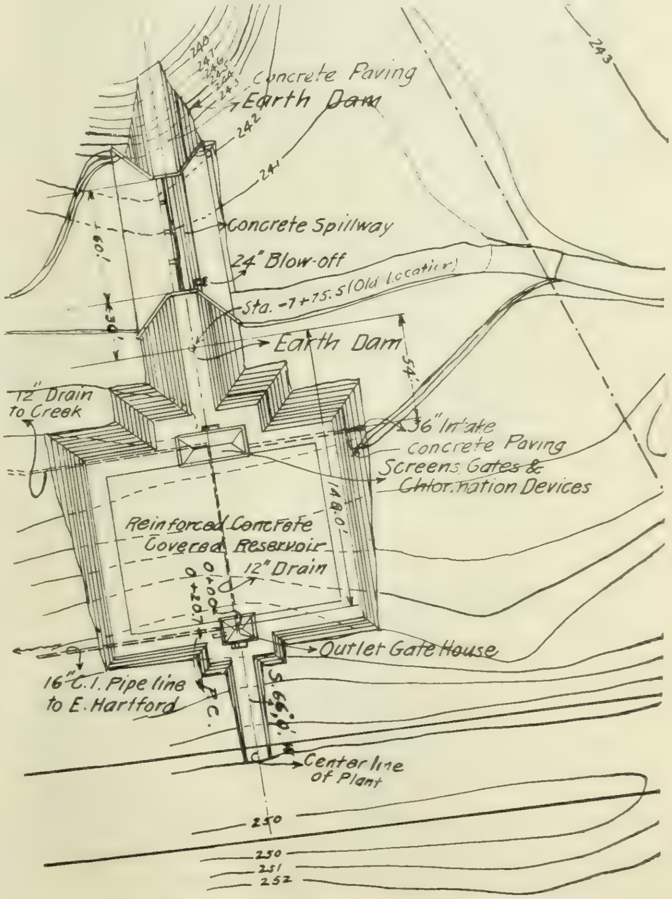
In September, 1919, a contract was awarded to the Beaver Engineering & Contracting Company, New York, to build the additions, comprising a low, reinforced concrete diversion dam on Cold brook, reinforced concrete reservoirs on Salmon brook and on Cold brook, to install a chlorinating apparatus at each reservoir, and to lay about 6.2 miles of 16-inch cast iron supply main from Cold brook to Glastonbury, to connect with the East Hartford fire district street mains there. This contract was awarded on the unit basis with an estimated total of about $320,000.

It is expected to provide a present supply of about 3,000,000 gallons daily from the regular run-of-stream without impounding reservoirs, which will afford abundant supply for the present needs of East Hartford, Glastonbury, the small manufacturing village of Burnside, and the town of South Windsor, which have a present combined population of about 25,000. This supply can be doubled by the construction at any time, for a moderate cost, of a storage reservoir, which will involve the building of a dam 40 feet high and about 500 feet long, affording sufficient provision for the probable increase of population and demands for at least 15 years.

DESCRIPTION OF RESERVOIRS

The Salmon brook reservoir, adjacent to the old settling basin, originally of about 2,000,000 gallons capacity, but now silted up to a capacity of probably not more than 1,500,000 gallons, is at the head of the old 14-inch supply line to East Hartford; a gate house and screen chamber being between the new reservoir and the old settling basin. The soil at the site consists chiefly of clean sand and gravel, well adapted for concrete aggregate, with a generally level surface. This was excavated to a depth of about 8 feet, forming a pit in which the rectangular reinforced concrete reservoir about 83 feet wide and 114 feet long is now under construction.

The reservoir has a 6-inch horizontal slab floor and, instead of the usual groined arch roof, has a 5-inch roof slab supported on 6 x 8- inch beams, 4 feet 7 inches centers, and 12 x 14-inch girders carried by the 12-inch exterior and center partition walls, and on rows of 12 x 12-inch columns 13 feet 9 inches and 13 feet 8 inches apart on centers. It will be covered by an earth fill 2 feet thick and it



GENERAL PLAN OF COLD BROOK DAM AND RESERVOIR has, at each end of the partion wall (which divides it into duplicate 54 x 81-foot chambers 10½ feet high in the clear), an inlet and outlet gate house, 14½ x 24 feet and 12 x 15 feet respectively.

The Cold brook reservoir, about 4 miles distant from the Salmon brook reservoir, is of similar construction and dimensions, but the clear depth between floor and roof slabs is only 8½ feet.

This reservoir forms part of a composite structure which extends across the valley of the brook, a total distance of about 375 feet at the lower end of 8-acre settling basin. This structure consists of an earth dam, a part of which surrounds the concrete covered reservoir, which is nearer the left bank; also a concrete spillway interposed in the earth embankment and nearer the right bank. The earth embankment which is 60 ft. long, is 6.5 feet high, except that 14 feet of this length is 6 inches lower, or about 6 feet above the bed of the creek.

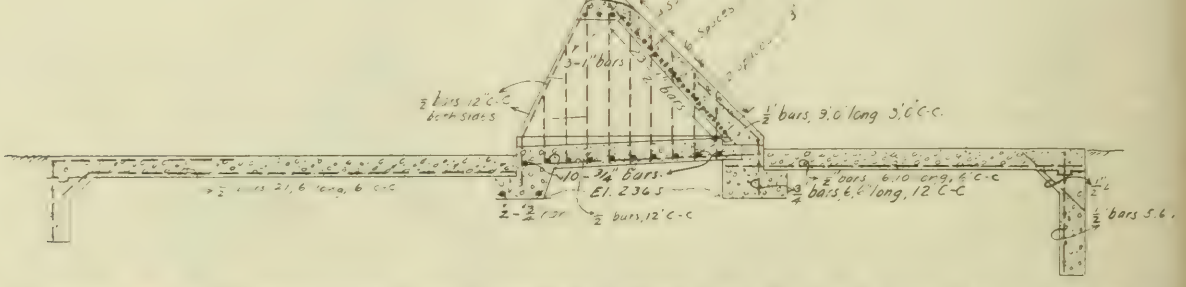
SPILLWAY

The spillway is built of reinforced concrete in the form of an inclined slab 12 inches thick, at the top and 18 inches at the bottom, having the lower edge integral with a horizontal foundation slab 12 feet wide and 12 inches thick. The inclined slab is supported on transverse vertical buttress walls 12 inches thick and 15 feet apart on centers. The horizontal slab is extended upstream and downstream by aprons respectively 15 feet 3 inches and 22 feet wide, integral with vertical cut-off walls 6 feet and 4 feet deep at the upper and lower edges. The ends of the concrete spillway terminate in concrete wing walls which protect the earth embankments 57 feet and 65 feet in length, which connect it with the hill on one side and with the reservoir on the other. The third embankment 55 feet long extends from the reservoir to the hillside. Work on this structure has not yet been commenced except for the clearing of about 14 acres, including and adjacent to the reservoir site.

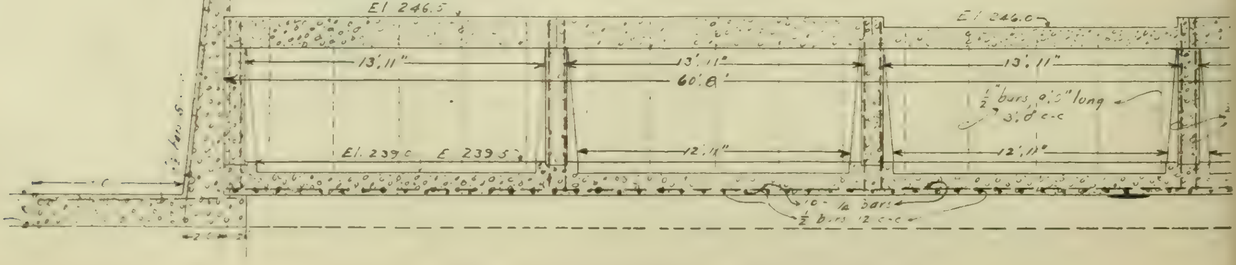
RESERVOIR CONSTRUCTION

About 2,000 yards of sand and gravel were excavated by scrapers and by two clamshell buckets operated by stiffleg derricks at the site of the Salmon brook reservoir. The sides of the pit were left at the natural slope and the materials were stored on top of the bank adjacent to them ready for use in back-filling over the top of the completed reservoir. No difficulty was experienced in excavation excepting where a small amount of quicksand was encountered and easily handled by the aid of hand diaphragm pumps operated in 3 x 3-foot sumps 2 feet deep, which quickly drained the soil and enabled it to be handled readily.

The sand and gravel, of excellent quality, were used for aggregate in the 1:2:4 concrete, mixed in a ½-yard Ransome machine installed on the bank near the foundation pit and delivered into 2-wheel Ransome carts operated on runway platforms built around the four sides of the reservoir and parallel to the dividing wall. The carts dumped into short sections of steel chutes, which conveyed the concrete to the required position on the floor and in the wall and column forms. The reinforcement, of both twisted and deformed bars, was assembled, wired together, and erected in position for the walls before the forms for the latter were set enclosing them. The forms were made up of large wooden panels about 10 feet by 12 feet, which were used three times and carefully cleaned and oiled after each use. It is estimated that the cost of the forms amounts to about $20 per cubic yard of all the concrete in the reservoir. The average number of men at work at the reservoir was about 30.



CROSS SECTION OF SPILLWAY SHOWING WIDE CONCRETE APRONS AND CUT OFF WALLS AT UP AND DOWN STREAM EDGES



PART ELEVATIONS OF COLD BROOK CONCRETE SPILLWAY

PIPE LAYING

The 16 inch pipe is delivered at Hartford by boat, and thence transported on automobile trucks and delivered along the line by a sub-contractor. Considerable difficulty has been experienced in securing deliveries on account of the congestion and interruption of freight service that has caused the work to be suspended at intervals.

The pipe line closely follows the hydraulic grade, and enables the system to provide a maximum effective head of nearly 200 feet in the lowest portions of East Hartford. The pipe trench has a minimum depth of about 5½ feet to provide for the required cover of 4 feet. The greatest depth is 22 feet and the excavation, amounting to about 24,000 yards, is mostly loam, sand and gravel with about 500 yards of rock and boulders that require drilling and blasting with black powder before removal.

A large part of the excavation is made with an Austin machine operated by four men, that digs a trench 30 inches wide at an average speed of 400 linear feet per day, with a record of 600 feet in 8 hours. Most of the material is so firm that the sides of the trench stand vertical without sheeting or bracing, care being taken to lay the pipe as rapidly as possible in the rear of the machine so that only a short section of the trench is left open. In some cases the ground is so hard that it is shattered with charges of about one-half stick of dynamite in center line holes 6 or 8 feet apart before excavation.

The pipe is handled in the field by tripods and hand tackles and is laid and jointed in the usual way with great care to secure solid support and tight joints. The back-fill is placed by an Austin machine operated by two men (although it can be handled by a single man), which does the work at an estimated cost of about 5c. per linear foot. The pipe laying force has varied from two to eight gangs, according to the amount of pipe available.

In the winter, when the ground was frozen hard, it was found advantageous to excavate the trench by hand in sections 5 feet deep and 8 feet long, leaving intermediate sections 4 feet wide between them through which a hole was tunnelled in the bottom large enough to permit the pipe to be thrust through and joints to be made in the open trench. In this manner a gang of 15 to 30 men excavated 200 linear feet of trench per 8-hour day.

PRINCIPAL QUANTITIES

The principal items of this contract for constructing the reservoirs, gate houses, dam, settling basin and pipe line include 8,900 yards of stripping and excavation, 4,600 yards of embankment, 1,725 yards of concrete, 24,813 linear feet of 16-inch cast iron pipe, 74 6-inch to 16-inch gate valves, 26 fire hydrants and 1,060 linear feet of 12-inch vitrified sewer pipe. It is estimated that on June 1st the contract was about 30 per cent completed.

Underground Roads For Automobiles

An underground system of roads for automobiles to relieve the growing traffic congestion in London was predicted by Lord Ashfield of Southwell in a speech at the American Luncheon Club. These roads could be connected with the outer districts of the metropolis by a system of boulevards to be reserved exclusively for motor traffic.

London is today the greatest riding city in the world, according to Lord Ashfield. Roads capable of dealing with 375,000 motor cars must be provided soon. He also predicted an increase in the number and size of underground railways in London.

No New Highway Work In California

State Highway Engineer A. B. Fletcher of California has stated that after 1920 no new work will be undertaken in that state. This decision is based on the unsalability of the state bond issue and the high cost of construction.

New York and Illinois have already postponed highway work until conditions are more favorable. The state auditor of Ohio has recommended the suspension of work in that state for the same reasons.

Payment For Estimating

In October, 1919, the American Institute of Architects, Engineering Council, and Associated General Contractors of America, each appointed three conferees to discuss the matter of payment for estimating. These conferees agreed upon a report which was submitted to their respective organizations under date of February 17, 1920, and has since been under consideration by them. Engineering Council at its meeting on June 17 adopted the conclusion on recommendation of a special committee, to which the report of the conferees had been referred, the wording of the action of the council being as follows:

> "Whenever in the execution of work, competitive bids are asked for on detailed plans and specifications, those invited to bid should be provided with such an estimate of the quantities involved in the work as the surveys, plans and specifications permit to be made. The intent of this requirement is that single estimate of quantities should be made by or for the engineer, architect, or other representative of the owner, so that each separate bidder will not be put to the expense of making up a separate schedule of estimates. This latter practice not only means a needless waste in the carrying on of the contract work, but also discourages bidders and causes needless repeated handling of official plans and specifications in making up separate schedules of estimates."

National Trucking Association

Representatives of motor trucking firms from all parts of the United States held a conference in the Hotel La Salle, Chicago, on June 26 and 27, to organize a national association to deal with the problems of long-distance trucking.

Among the questions discussed were the construction of highways powerful enough to withstand the heavy loads, study of automotive constructive elements, research in operating costs and equalization of loads, problems connected with the necessity for co-operation between commercial haulers in different cities, in order to keep trucks supplied with return loads from long distances and many other matters vital to the industry.

Representatives from New York, Iowa, Michigan, California, Pennsylvania, Ohio, Indiana, Missouri, Massachusetts, Nevada, Texas, Colorado, Oregon, Illinois, Louisiana, Nebraska and other states were in attendance.

American Water-works Association Convention*

Conclusion of Narrative of Convention begun in last week's issue. The papers and discussions of Thursday—"Superintendents' Day"—are referred to in this instalment.

THURSDAY SESSIONS

Thursday was set aside as Superintendent's Day, to be devoted to papers and discussions of a practical nature. During the morning and afternoon, the Chemical and Bacteriological Section held sessions in an adjoining room. As already described, the main sessions were broken in upon by somewhat protracted discussions resulting from the reconsideration of a motion adopted the previous day relative to a proposed change in the constitution governing the method of selecting a secretary.

Owing to the unfortunate absence of Caleb M. Saville, who was chairman of the Committee on Standard Specifications for water meters, no formal report of that committee was made but merely one on progress.

Discussing "The Proper Size of Meter for Multiple-family Houses," H. P. Bohman described the system employed in Milwaukee. Here the regulations required the meter to be the same size as the corporation cock, and the minimum size now used for this is ⅝ inch, although there are in service quite a number of smaller sizes which were installed some years ago. G. A. Elliott reported that in San Francisco a ⅝-inch meter was used for any number of families up to 6, a ¾-inch meter for 7 to 10 families, etc. D. W. French, describing the practice of the Hackensack Water Company, which supplies a number of communities in New Jersey, stated as his opinion that no fixed rule for size of meter was practicable, since this would be influenced by the pressure in the mains and other conditions. They used meters as small as ½-inch for two-family houses, a ¾-inch meter for 5 to 10 family houses, etc. W. R. Edwards, assistant superintendent of the Passaic Water Company, which also supplies a large number of New Jersey communities, stated that that company uses ⅝inch meters for houses containing up to 6 families and ¾-inch meters up to 12 families. A. W. Cuddeback, engineer and superintendent of the Passaic Water Company, believed that a meter should be large enough to give good service, and gave it as his experience that a half-inch meter would not do this for even one family. J. N. Chester and others also spoke on this subject, Mr. Chester advocating abundant size in meters so that dwellers on the upper floors of residences and apartments could obtain water while it was being drawn for washing or bathing on the lower floors. One member reported that a 6-inch compound meter was found to register only about half the consumption because the prevailing rate of consumption was just at the critical point between the two meters, and the income from the service was increased by 80 per cent by changing to a smaller meter. One superintendent reported that he found in too many cases that the stop and waste valve in the cellar was too small and reduced the pressure, while others referred to the fact that a ⅝-inch or ¾-inch corporation cock has not really a passage of that size, and that this and too small service pipes reduced the pressure more than did the meter. W. H. Buck reported that in Riverton, N. J., no service less than one inch was allowed, except that ¾-inch was permitted if lead pipe were used.

A paper on the "Standardization of Water Works Supplies" was read by Adolph Mueller, in which he reported that the manufacturers of water works brass goods were arranging to standardize such goods and reduced the numbers of patterns by about 75 per cent. This should not only reduce the amount of stock and number of tools which it was necessary for the manufacturers to carry, but because of this should make it possible to reduce the cost somewhat for the purchasers. Among other things he expressed the hope that a ⅝-inch or ¾-inch cock under the new standard would be an "honest-to-God" appliance giving a waterway of the size named, and that this should be given the proper shape to minimize friction losses. Following Mr. Mueller's paper, it was voted to appoint a committee to confer with the committee of the brass goods manufacturers and with a similar committee of the New England Water Works Association.

The afternoon session opened with a paper by C. R. Knowles entitled "The Prevention of Water Waste on Railroads." This paper was illustrated by lantern slides showing horrible examples along the lines of the Illinois Central Railroad. By educating the employees to less wasteful practices, the company had been enabled to decrease the consumption by 18 per cent.

John Murphy, of Ottawa, then gave a very interesting talk on ice formation, illustrated by lantern slides, including moving pictures showing the formation of ice in a glass beaker. The amount of heat, said Mr. Murphy, required to prevent the formation of ice was very slight compared with that required to melt ice after it has formed. If the temperature of the metal in a water wheel or in screens can be kept a minute fraction of a degree above 32 degrees, the water will not freeze to such objects, even though the temperature of the water be slightly below freezing. He cited an instance where a factory discharging a comparatively small amount of warm water into a Canadian stream, it being estimated that the amount of warm water was not more than 1-500 of the volume of the stream receiving it, prevented the formation of ice, although in former years an ice company had every winter cut heavy ice on this stream a mile or two lower down. Because of this the ice company brought suit against those who were discharging the warm water into the stream and proved its case. The moving pictures showed a beaker full of water a very little below freezing temperature, but containing no ice. Stirring this with a rod, frazil or needle-ice was seen to form and float to the top, the same occurring when agitation was effected by moving up and down rapidly an iron nut suspended from a string. An iron bar at a temperature slightly below freezing was inserted in the water and ice was seen forming around it. It was believed to be demonstrated by this experiment that the formation of ice required more or less agitation or else a nucleus created by a body whose temperature was below freezing. Illustrations were shown of iron casings of water wheels and other iron objects which contained hollow passages through which warm water was kept moving during freezing weather, which entirely prevented the formation of ice around such objects, although in previous winters their operation had been interfered with and some times entirely prevented by such formation.

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*Concluded from the July 3 issue, page 8.

Following this Dr. Gellert Alleman read a paper entitled, "Some Aspects of Electrolysis." He stated that there was no cure-all for electrolysis, but that almost any condition could be remedied by the application of one of several accepted methods, although under other conditions such method might be far from satisfactory.

"The Revenue Chargeable to Public Uses of Water in the City of Rochester," by Stephen B. Storey, was the first paper of the evening session, Mr. Storey going quite fully into the practice of the water company in Rochester and calling attention to some items of public use for which the water department was not credited by the city. His method of determining the amount which the city should be credited for fire protection, namely deducting from the total cost of the plant the cost required for providing all services other than fire protection, brought forth the remark from one member that he thought a more just method was to apportion the entire cost in proportion to the cost of a plant designed for either purpose alone, while another member stated that he would simply reverse the method described and would base the fire protection cost on the cost of a plant designed for fire protection only.

This paper was followed by one entitled "Damage to Deep Wells by Sea Water," by Dr. William P. Mason. The paper dealt with an investigation made by Dr. Mason to determine whether damage would be done to the wells of the Queens County Water Company should a canal be excavated from Jamaica Bay to the Great South Bay passing within a thousand feet of the nearest well by one route and fifty feet by a second route. As to the second route, there was no question at all but that salt water would reach the well. As to the thousand feet, Dr. Mason did not feel certain, but after investigating the data available and considering the nature of the ground, which is pure sand, and that his investigations led him to believe that a well which had once been ruined by the accession of salt water never recovered, he reported that there was danger that the construction of the canal would ruin the wells and thus entitle the water company to considerable damages. Two or three other members questioned Dr. Mason's opinion that a well once salt never recovered, by citing instances where such recovery had taken place.

The Associated General Contractors of America, through one of their members, made to the society a plea for the adoption of modifications in contracts as now in common use, presenting the standard paragraphs which they desired, which were published in Public Works of June 5.

Leonard Metcalf presented a paper entitled, "The War Burden of Water Works in the United States Continues," in which he presented figures supplementary to those given to the society last year, showing that prices of materials and services used by water companies were on the whole greater even than a year ago, that there was no immediate prospect of any considerable reduction in them, and that consequently cities and companies which had not already done so might still find it necessary to increase rates; certainly, some increase in revenue must be necessary to meet the continued high cost of the services rendered.

Segregating City Traffic

Providing for a two months' test in Cleveland of the practicability and results of prohibiting heavy vehicular traffic on certain streets, favoring rapidly moving vehicles thereon.

We have received from Robert H. Whitten, special city plan advisor of Cleveland, information concerning recent action taken by that city, Mr. Whitten having been led to send it by an editorial published in Public Works of May 22.

The information sent consists first of a report by Mr. Whitten and Frank R. Walker, as city plan advisors, in response to a request by the city council for advice relative to "the feasibility of prohibiting traffic on certain newly paved main thoroughfares in the city of Cleveland, with special reference to eliminating heavy vehicular traffic from operating in Franklin Avenue." The remainder of the material forwarded consists of the ordinance adopted, providing for a two months' test of the recommendation contained in the report, the ordinance providing that under rules to be promulgated by the director of public safety, for limited periods not exceeding 60 days heavy vehicular truck traffic shall be barred from five specified streets; provided that vehicles making deliveries of goods and merchandise may be permitted on these thoroughfares, but such vehicles must enter and leave the thoroughfares by the nearest intersecting streets. Also, it was provided that, on the conclusion of this test, the Director of Public Safety report to the council showing the results of it.

The report of the city plan advisors is so general in its applicability, that we quote it entire in the following paragraphs:

"Where there are two parallel thoroughfares serving the same general section of the city, it is in some cases highly desirable from a traffic standpoint to use one of these thoroughfares primarily for fast moving vehicles and the other thoroughfare primarily for trucks and other commercial vehicles. Such a segregation of traffic will increase the traffic capacity of both thoroughfares.

"In New York City portions of a number of principal north and south thoroughfares such as Fifth avenue, Park avenue, Fourth avenue, Seventh avenue and Broadway are now reserved primarily for the use of automobiles. Commercial vehicles may not enter these thoroughfares except to receive or deliver goods. This regulation has been in force over a year and is said to have worked well.

"In Cleveland the thoroughfares that could most appropriately be reserved for automobile traffic are: Carnegie avenue from East 71st street to East 100th street; Wilbur avenue from East 100th street to East 107th street. Fairchild avenue from East 107th street to Stearns road; Franklin avenue from Franklin circle to West 85th street; and Lake avenue from Clifton boulevard to West 117th street.

"Trucks that use Franklin avenue can be routed without great inconvenience through Detroit avenue, Lorain avenue or Madison avenue. Trucks that use Lake avenue can be routed through Clifton boulevard or Detroit avenue. Trucks that use Carnegie avenue, Wilbur avenue and Fairchild avenue can be routed through Cedar avenue.

"The roadway on Cedar avenue east of East 89th street has recently been repaved and widened. The pavement in the car tracks from East 55th street to East 89th street is in good condition and the pavement between the car tracks and the curb in fair condition for trucking though the roadway is narrow. This portion of the roadway should be repaved and widened. On East 55th street the pavement is in good condition from Euclid avenue to Carnegie avenue but should be repaved in the block from Carnegie avenue to Cedar avenue so that through trucking would be induced to turn down East 55th street to Cedar avenue.

"The restriction should probably apply to all motor vehicles constructed or specifically equipped for the transportation of goods, wares or merchandise and should apply to all horse drawn vehicles. Exception should of course be made in favor of fire apparatus, ambulances, U. S. mail, city department vehicles and emergency repair cars of public utility corporations. There should also be an exception in favor of vehicles receiving goods or making deliveries or transacting any other business along the restricted thoroughfare. In order to prevent the abuse of this privilege, such vehicles should be required to enter and leave by the nearest intersecting thoroughfare. If, however, they are receiving or delivering goods at a number of places not more than half a mile apart, they should be permitted to pass along the restricted thoroughfare between such stops.

"It is believed that a start in traffic segregation on the avenues above specified will be distinctly advantageous in improving traffic conditions. The present mixture of traffic, especially on Carnegie avenue, leads to congestion and results in numerous accidents. Traffic is becoming heavy on Franklin avenue and the restriction as here proposed will prevent the development of traffic conditions similar to those now obtaining on Carnegie avenue.

"In order to make a traffic segregation ordinance effective conspicuous notices should be placed at all important intersections along the restricted thoroughfares. In addition it will probably be necessary, for a time at least, to have one or more motorcycle policemen assigned to the enforcement of the ordinance."

Tunnels Under the North River, New York

Regarding the practical conditions fully established by shield-driven tunnel construction under the North and East rivers, New York, specific statements recently made by John F. O'Rourke are very pertinent to some of the points that have been disputed in recent discussions of the proposed Hudson River Vehicular Tunnel.

Mr. O'Rourke wrote, not in controversy, but as a matter of personal knowledge:

"Wherever the river bed is soft along the line of the tunnel for a distance down that would not leave enough hard material to hold the air and leave solid ground around the tunnel, that the only thing necessary to do would be to drop heavy clay some time before the shield would reach the place, in a wide mat.

Our experience shows that heavy clay invariably displaces the light, soft clay and unites with the hard clay below, so that the tunnel can always be kept in solid ground. This clay cuts like cheese, and holds its form for some time, so there is no difficulty in packing the space around the tunnel lining with gravel, thus holding the ground without movement and the tunnel lining in position and form as set. This should dispose of all questions in regard to extraordinary stresses in the tunnel lining and produce a situation the same as existed in the Pennsylvania tunnels about a year after the cast iron lining had been placed. As stated by myself, Fitzgerald and others, the river bed had closed around the cast iron lining by that time, and such braces or tie-bars as had been put in the tunnel were taken out and the ground outside produced no effects whatever on the lining."

Forest Products Laboratory Decennial

We are requested to extend a general invitation to all who are interested, to attend the decennial celebration of the Forest Products Laboratory which will be held at Madison, Wis., on July 22 and 23. On the afternoon of July 23 there will be held a conference of representatives of various wood using industries and the question of national forest policy will be discussed. Further information can be obtained by addressing Don E. Mowry, Cantwell Building, Madison, Wis.

The laboratory is operated as a branch of the Forest Service of the U. S. Department of Agriculture, in co-operation with the University of Wisconsin. It is an institution of industrial research devoted to the study of the properties and economic uses of wood.

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Providing For Increasing Water Supply

In planning for gravity water supplies, it is of course necessary that allowance be made for a future consumption considerably greater than the present. In fact, an eye should be had to an almost indefinite future, since through all time, it would seem, the city must obtain a supply of water proportional to its population. This applies to the amount of water obtainable, but not necessarily to the works for developing and transporting all of it.

Where provision for the future involves the securing of several sources of supply, no one of which would be sufficient, probably the more common practice is to develop some one or two sources to the limit. The other plan would be to make a partial development of all of them. This was the one adopted by East Hartford, Connecticut, as explained elsewhere in this issue, the conditions as to stream flow being such that practically no storage is required at present to insure a continuous ample supply.

Where storage in any volume is called for, however it will generally be most economical to develop to the full some one supply, rather than build a low dam now and later add to its height or build another higher one lower down. The deciding element of the problem will ordinarily be the expense, and this should be studied carefully, a comparison being made of the several alternatives possible.

Variations In Public Works Contract

A few years ago few contracts were let which could not be classed definitely as either "lump sum" or "itemized bid," and the form of contract, both general and in detail, was almost stereotyped. Now-a-days the arrangements made by public officials for having work done vary from the old forms, through numerous differentiations to performance directly by the officials themselves. Almost every issue of Public Works describes some plan slightly different from the others.

We have cost plus fixed sum, plus fixed percentage, plus variable percentage; lump sum or itemized bids with additions or deductions to allow, wholly or partly, for variations in cost to contractor of labor, materials, freight, etc.; payment of rental for contractor's plant and salary to contractor; furnishing material and possibly part of plant to contractor; and each week brings to knowledge some new idea on the subject, either adopted or proposed.

The contractors probably have had little to do with originating these, but the Associated General Contractors are urging the acceptance by officials, and "parties of the first part" generally, of certain principles to be embodied in contracts of whatever form, which will tend to relieve them of the uncertainties and risks which they are now compelled to assume. A contract is an agreement between two parties which is presumably mutually satisfactory and equally advantageous to both; and the desires of the contractors should certainly have equal weight with those of the other parties to the contract in the preparation of the contract terms.

Of the numerous forms of agreement being tried out many are demonstrating their improvement over the older ones; state laws, unstability of market prices, labor and other local conditions often determining the efficiency or otherwise of certain features of the agreement.

The result, it seems to us, can not help but be an evolution of a few new forms of agreement for the performing of work by contractors, which will result in a closer and more amicable relation between them and the engineer in charge; a pride of the former as well as the latter in the excellence of the work completed; and in general, greater satisfaction to all fair-minded parties concerned.

Effective Strike Remedy

The strike of truckmen, longshoremen and others that was intended to throttle New York City, extort still higher wages and compel the acceptance of closed shop in all freight handling there, has been frustrated by a very simple and obvious expedient that should promptly be put into force in many other situations.

The victims (or rather the most direct victims, for the entire city and many national interests suffered present loss and great future danger) simply organized and financed a system of doing the work that the strikers refused to do, and in less than two weeks, assisted by individual operators, moved more than 6,000 tons of freight which congested the coastwise piers, and now have them cleared for normal transportation.

In this case the financial backing and public opinion were so strong that intimidation could not prevail against them, and the strikers did not dare to employ the sabotage and violence so general in large strikes. The result confirms the belief that very few strikes directed against governments, municipalities, utilities, or great industrial enterprises would succeed if life and property rights were adequately protected and strikes conducted in a legal manner.

The open shop is the cornerstone of industrial and commercial safety and is indispensable to the rights guaranteed by the Constitution of the United States. There is a malignant determination to destroy it which would quickly disappear if every business man would join in a universal crusade to establish open shop wherever it is now lacking, by methods similar to those used so successfully in New York.

Farewell to Yesterday

It is reported that the French Parliament has authorized the demolition of the historic wall enclosing the city and the use of the military zone outside it for city improvements. It is proposed to completely surround the city by a park having an average width of about 750 feet which, with the grace and beauty that Paris always gives to her public monuments, will undoubtedly be a great improvement for the city, but it is regrettable that it will be made at the expense of the historic wall that made such an interesting landmark associated with so much that is vital and romantic in legend and history. Although the wall has long since ceased to possess important military value, it could not be considered quite useless because it interposed a sufficient barrier to restrict entrance to the city to definite thoroughfares and to provide an obstacle that would require ordnance or an appreciable length of time to remove it for the entrance of troops which of course it could not ultimately prevent.

No longer ago than the beginning of the great war, some of the gates in the wall were specially guarded in anticipation of the approach of advance troops of cavalry and for months afterwards there could still be seen adjacent to them, huge piles of structural steel hurdles ready to scatter over a long stretch of the boulevards with the intention of impeding the enemy sufficiently to enable the machine guns to operate efficiently.

Montreal Labor Convention

There is one important point in favor of the Montreal Convention of the American Federation of Labor; it has come out, naked and unashamed and announced its principles, stating its demands in no uncertain terms and giving due notice to the country that it will omit no effort to overthrow civil, financial, political, social and humane rights that may be opposed to its domination. It has passed many resolutions indicating complete disregard of the rights of all except members of the labor unions and has exhibited a monumental inability to co-ordinate cause and effect, as for instance in the clamor for the reduction of prices and the high cost of living at the same time that it insists on impossibly high wages, forgetful of the fact that, according to statisticians, about 80 per cent of the cost of all commodities goes to labor and that labor is therefore already accountable for four-fifths of the increased prices.

The convention voted support to the striking longeshoremen that by their unjustifiable demands are paralyzing both domestic and foreign trade and threatening the life and prosperity of great cities and of the whole nation.

They demand government ownership of railroads, in spite of the fact that the government control has already thrown that formerly wonderful efficient system into chaos little short of destruction, and still constitutes a great peril to the whole country.

They have directly attacked efficiency and production by the instructions to the executive councils to render all possible assistance to "abolish present unreasonable speed tests, time measuring devices and the unreasonable standards of personal efficiency in the postal service."

Their condemnation of military training in schools as "the first step," which results in the killing of the initiative and the characterization of compulsory military training as "unnecessary, undesirable and un-American" is a most unpatriotic and cowardly principle that if admitted by any large proportion of the inhabitants would make the country defenseless against both internal and external warfare and dangers.

They seek to throttle production and secure a monopoly dictating to the entire country by prohibiting immigration as illustrated by the demand for congress to cancel the agreement with Japan and absolutely exclude Japanese and other Asiatic immigration to this country.

They oppose conservative reliable government and the protection of citizens by their instructions to the executive committee to obtain the reinstatemen of the striking Boston policemen and to give the latter their moral support.

Evidently in recognition of the demands that labor has made on the great political parties, the Republican platform adopted at Chicago included planks recognizing the justice of collective bargaining, repudiating the principle of compulsory arbitration, demanding the exclusion from interstate commerce of the products of convict labor, and opposing no strikes except those actually directed against the government.

Notwithstanding these remarkable concessions for class privileges at the expense of the nation, the convention unanimously condemns the Republican platform as a document "defiant in its defense of the enemies of labor" and that "proposes an industrial enslavement and an abrogation of rights as precious as life itself."

It specifically attacks the Republican party because, among other things, it "denies labor the right to strike against the government; because it repudiates labor demands for repeal of compulsory arbitration sections of the Esch Cummins Transportation Act; because it "Aims to undermine sovereignty of Mexican people and fulfill the hopes and aims of those whose sole object is the exploitation of the people and boundless resources of Mexico;" and because it "fails to urge congressional legislation to prevent Federal courts using their authority in declaring unconstitutional acts passed by congress." In other words, it defies the laws of the country and demands that they be repealed and that new laws be made favoring the greed and domination of labor as opposed to the overwhelming majority of the general public.

If such impudent declarations as these do not demonstrate the immediate necessity for enacting and enforcing stringent legislation against government and utility strikes and to make responsible this great organization of irresponsibles, what will?

New Water Supply Works of Winnipeg[*]

By James H. Fuertes

This instalment discusses the probabilty of freezing in the aqueduct, and adapting of size, grade and location so as to minimize the cost.

Temperature of Water Flowing Through Aqueduct—As to temperatures of the water at Indian bay, as compared with the temperature in the city reservoir, after passage throgh the 100 miles of aqueduct, it may be remarked that there is practically no difference, at any season of the year. The temperature at the intake, as well as at the city reservoir, gradually decreases, from the time the ice begins to form on the lake in November until a minimum of 2°C (35.5F) is reached in December at the reservoir, persisting until March; from the time of the break-up in the Spring, generally in April, there is a gradual rise in temperature until a maximum of 22.50 (72.5F) was reached in July and August, being followed then by a gradual dropping until the freeze-up.

In the distribution system of the city the temperature of the water rises somewhat in winter and falls in summer. In the heart of the city, where the pipes are large and the quantities of water used are large, the temperatures do not vary more than a degree or two from those in the city reservoir; approaching the limits of the city there is a gradual rise in winter to a temperature of about 2.5C (38.5 F.), and in summer a gradual drop to a minimum of about 6°C (43°F).

The outstanding feature, respecting temperatures, is that throughout those cold winters, when the cold penetrates the ground sufficiently deep to cause thick hoar frost to collect on the arch of the aqueduct above the flowing water, enough heat is radiated into the water from the ground to a little more than balance that lost at the surface during winter, and the reverse during summer to enable this water to keep at a practically constant temperature while flowing about 100 miles.

This result bears out the predictions made in the report of 1913 that 4 feet of cover would be a sufficient protection to the aqueduct, as far as frost-proofing was concerned, although it was known that in some localities frost penetrated as deep as 9 feet in cold winters; in fact, in Winnipeg, small service mains freeze sometimes in June and July, at that depth.

Prior to the completion of the aqueduct, at the suggestion of Gen. Ruttan, formerly city engineer of Winnipeg for many years, an experiment was made in a completed portion of the aqueduct to reproduce, as well as might be, the conditions to be expected of the aqueduct when in operation.

A section of aqueduct was chosen, running westward from the Birch river crossing, at which point water could be diverted into the aqueduct, and turned out again after passing through 3 miles of the aqueduct, into a ditch at the west end of the section under test. As the aqueduct slope was too steep to control the flow by a dam at the lower end, three sand-bag dams were built in it, one at the lower end, and two others at intervals about 1,000 feet up stream.

This aqueduct had the standard 4 feet of cover of sandy, loamy material. Water was regulated to enter from the river at the rate of 130,000 gallons per day, and at that rate required about a week to travel the three miles before escaping, being held back by the dams, to subject the water to aqueduct temperature for about the same time that would be required for water to flow from Lake of the Woods to Winnipeg at the minimum rate of operation, 25 million gallons per day.

The first set of temperatures was taken on February 2nd, 1917, and they were as follows:-

	Air in Aqueduct	Water in Aqueduct	Depth of Water in Aqueduct
Entrance to Aqueduct...	29°	33°	3½"
1st Dam	36°	36°	40 "
2nd Dam	37°	37°	40 "
Last Dam	37°	37°	56 "

Temperature of outside air, —14°. Temperature of water in river, 32°.

No ice or frost appeared on roofs or walls of aqueduct or on the water flowing.

From the last dam to the 2nd, the depth of water decreased gradually from 56-inches to 3½-inches in about 3,500 feet, and remained at 3½-iches for about 1,000 feet. Between the second and first dam the depth decreased from 40-inches at the dam to 3½-inches in 2,500 feet, and remained 3½-inches to the first dam, about 1,500 feet.

Observation repeated in March gave practically the same results, although the outside air had raised to 32°F, and the long-continued cold had penetrated the backfill over the aqueduct, causing a strip of hoar frost 2 feet to 6 feet wide to form to a depth of ¼-inch on the inside of the top of the aqueduct.

CONTRUCTION RAILWAY

Owing to the inaccessibility of the country through which the aqueduct would have to be built, the long stretches of swamps, muskegs and trackless forests to be crossed, one of the essential featres of the whole proposition was the construction of a standard gauge railway, with numerous sidings, paralleling the aqueduct throughout practically its whole length, in order to open up the country and make it possible to deliver men, equipment and materials along the line of the work promptly and economically.

The railway was well built, heavily ballasted, and laid with 60-lb. steel rails. At the Winnipeg end it had connections through the transfer yard with all the railroads entering Winnipeg, so that freight could be handled and transferred at minimum cost and in quickest time.

Quite a bit of the road bed had to be carried on cross poles, logs and brush, covered with earth and ballasted very heavily; and in some places a great deal of work was required, during operation, in the way of train-fills, to keep the road up to surface to prevent derailments. Work was begun on it in March 1914, and the rails reached Indian bay December 10th of the same year. The total cost, including equipment, was a little under $1,500,000 or about $13,100 per mile of track.

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[*] Continued from page 5.

LINES AND GRADES FOR AQUEDUCT

Economical Depth of Cuts—The establishment of the proper alignment for the aqueduct involved a study of costs balanced against grade lines. The preliminary profile prepared for the report of 1913 furnished the base for comparisons. The cost of an aqueduct section on any given grade varied with the position of the invert with respect to the ground level. Very shallow cuts, requiring large embankment quantities for covering the aqueduct and very deep cuttings, both cost a great deal more per foot than a moderate average cut. Comparative estimates of cost, including the stripping, excavating, timber platform, concrete, and backfilling, showed that for local conditions and methods of payment, an average cut of from 4 feet for the smallest to 5.5 feet for the largest section gave the minimum costs per foot of completed work, and that with a range of half a foot either side of the most economical depth there was practically no difference in cost.

After the preliminary line had been run through from Winnipeg to Shoal lake it was found that there were three critical points through which this line had to pass—one was the west end of Snake lake, near the Lake of the Woods. Another was the crossing of Brokenhead river, where moving the line very far either side of the chosen crossing would greatly affect adversely the grade line, or increase the length of the inverted syphon required to cross this valley or plain. The last was the passing from the Brokenhead to the English river drainage basin, where there was but one low saddle to follow without swinging the line far away from the short route.

Foundation Conditions—With these points fixed, the problem resolved itself into finding the most suitable aligment, for the least cost, to connect the points into a continuous line. Had the country been dry or the sub-soil the same throughout, the problem would have been much simpler; but in places, although the natural ground level was at a favorable height, the sub-soil was so wet and soft as to be unsuitable to carry the aqueduct, requiring either (1)-a pile fondation; (2)-the removal of the soft ground to a solid bottom and the refilling of the trench with gravel hauled in by train and deposited and spread in the trench in water kept standing high enough to entirely submerge the gravel until the surface was raised a few inches above the finished grade of the aqueduct (many miles of foundation had to be prepared in this way); or (3)-the depression of the aqueduct sufficiently below the hydraulic grade to secure a solid bottom and the reinforcement of the concrete work so as to stand the resulting internal pressure.

As finally located there were nine of these depressed sections with pressure heads varying from 7 to 65 feet.

Effect of Slope on Cost of Aqueduct—The general problem as to alignment, therefore, was one of finding the line giving a grade averaging as close to the mean slope between termini as possible without diverging so far from the shortest practicable line as to have the extra length cost more than would be saved in concrete, excavation and foundation costs, by using a longer alignment on a flatter slope. Thus, with the 7-foot x 8-foot 3¾-inch aqueduct the line could be lengthened 14 per cent to avoid a cut 6 feet greater than the most economical depth of cut.

Excepting at the critical points spoken of, the entire country was so flat, so heavily covered with brush and timber, or so wet and boggy, that the eye was no guide in picking out the proper line. Levels had to be run on offsets from the preliminary lines, sometimes as far as 20 miles at right angles, along section lines that had been cut out, so as to get a comprehensive contour map, with contours at 1 or 2-foot intervals, to trace out thereon the best line to follow to secure good grades, good lines and avoid difficulities in other places.

In addition to this, soundings and wash borings had to be put down in soft places and in swampy areas to locate the hard sub-soil and determine whether to use a foundation fill, depressed section or pile foundation to get the aqueduct through, and determine the cost.

Hydraulic Gradient at East End of Aqueduct—In the establishment of the grade of the aqueduct there were some novel points. The first relates to the passage of the aqueduct from Indian bay to the valley of Boggy river, through a deep cut 9 miles long. The height of the water in Indian bay fixed the range of levels available to govern the entrance of the water into the aqueduct, and the depth of cutting, influenced greatly by the grade of the aqueduct, controlled also the size of the section, and hence the cost.

Naturally a very slight slope was adopted for the long 9-mile cut, at the end of which the grade steepened considerably, and this circumstance was availed of in the following way. The grade adopted for the nine mile cut was 0.11 ft. per 1000 and the depth of flow on this slope to discharge 85 million gallons daily through the 10-foot 9-inch x 9-foot section of aqueduct would be 7.25 feet. The slope of the next section was 0.279 per 1000 feet and the depth of flow, with the 8-foot 10¼-inch x 7-foot 5⅝-inch section was 6.26 feet for 85 million gallons daily discharge. By continuing the large section past the junction of the two grades and down on the steeper slope for 11,100 feet, then changing to the smaller section, the water surface at the junction of the flat and the steep slopes would drop to give a depth of flow of 4.98 feet instead of the 7.25 feet required to discharge the same quantity on the 0.11 grade, and the larger aqueduct would have the advantage of this additional slope without the necessity of dropping the aqueduct grade. In other words, this expedient to secure discharging capacity made possible the placing of the invert grade, through the deep nine-mile cut, an average of about 10 inches higher than if the large section had ended and the smaller begun at the break of grade, and still discharge the required 85 million gallons per day at low water in Indian bay.

Also, using the 10-foot 9-inch x 9-foot aqueduct had the further advantage that at high water in the lake the capacity of this large section would be about 120 million gallons per day, so that at the very slight additional cost required for the larger section this portion, the most expensive of all the aqueduct, would not require duplication for a very long time in the future. These conditions are shown in the accompanying diagram.

Provision for 2nd Aqueduct for Increasing Supply in Future—Should, in the future, the rate of consumption pass the 85 million mark, it is contemplated to install a booster pumping station to raise the lake water the few feet required, when required, and run the aqueduct section under a slight head of from nothing to about 4-feet for the first 5 miles of its length.

Provision was made, in the works as built, for the junction of a second aqueduct to the existing one at the end of this extended large section, so that advantage could be taken of these conditions when the demand for water should exceed the capacity of the existing aqueduct, without interfering with the supply of water to the district.

General Description of Aqueduct—From this point to the site of the proposal equalizing reservoir at Deacon, about 12 miles from Winnipeg, the problem of grades was simply one of adjusting the alignment to secure that line which could be built for the least cost; in other words, equating lengths and corresponding unit costs as determined from the resulting grades and foundation difficulties to give the least cost between termini. Usually, in locating gravity aqueducts, there is little choice in selecting a route, topographical difficulties controlling and limiting the location to one practicable line.

In the case of the Winnipeg aqueduct, however, the country was so flat and its general slope so uniform that, as far as slopes were concerned, an aqueduct could have been run through on an almost straight line between Winnipeg and Shoal lake. Such an alignment would, however, have cost from two to three million dollars more than the one final-

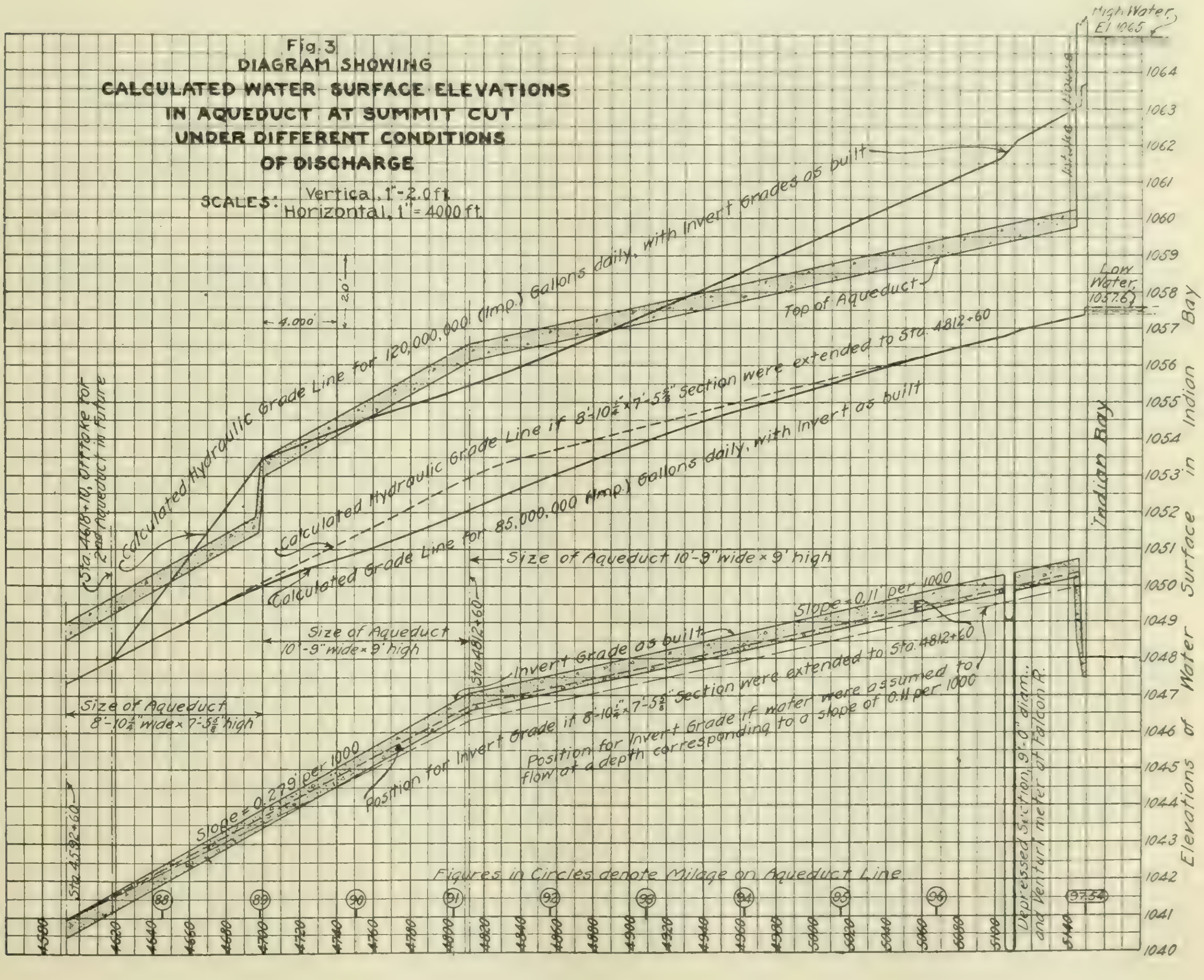


Fig. 3
DIAGRAM SHOWING
CALCULATED WATER SURFACE ELEVATIONS
IN AQUEDUCT AT SUMMIT CUT
UNDER DIFFERENT CONDITIONS
OF DISCHARGE

ly located, although several miles shorter, as it would have consisted of long stretches of nearly level grades, joined by short stretches of steep grades, and the resulting aqueduct would have been made up of a large percentage of large sections and a small percentage of small sizes of aqueduct.

From the intake westward to within about 17 miles of Winnipeg, a distance of 80 miles, the slope of the ground is such that a gravity aqueduct, planned to run not quite full, was used. The section is horseshoe-shape, except where depressed below the hydraulic grades at a river crossing and near Winnipeg. These portions are circular and reinforced for internal pressures.

The largest gravity flow section is that through the summit cut above described, which is 10 feet 9 inches wide and 9 feet high on a slope of 0.58 feet per mile; the smallest is between miles 23½ and 32½, which is on a slope of 1.537 feet per 1,000 feet (8.11 feet per mile, the steepest slope on the whole line) and is 6 feet .4¾ inches wide and 5 feet 4¾ inches high.

HYDRAULIC GRADIENTS AT WINNIPEG END OF AQUEDUCT

From Mile 17 westward toward Winnipeg the ground falls off in elevation so that, to deliver water into the Winnipeg reservoir, the aqueduct must run under pressure, and here again enter some interesting hydraulic problems. All the aqueduct above described, that is from Mile 17 eastward for 80 miles, has a discharging capacity of 85,000,000 imperial gallons daily, a quantity far in excess of the needs of Winnipeg for many years.

General Conditions—The plans as worked out for this western end are based on construction details such that quantities up to 28,500,000 gallons daily may be delivered by gravity through the system into the McPhillips street reservoir in Winnipeg at elevation 769.5, which is high-water level in that reservoir. That is, from the western end of the gravity flow aqueduct at Mile 17 to Deacon, at Mile 13, there is a depressed section, having a diameter of 8 feet, followed by 49,900 lin. feet of 5-foot 6-inch lock-joint pipe, reaching to Red river in Winnipeg; than a 5-foot diameter cast iron lined inverted siphon under the river, and a 41 inch lock-joint reinforced concrete pipe 11,400 feet long through the streets of Winnipeg to the McPhillips street reservoir.

As a part of the system, but not for immediate construction, it is planned to provide at Deacon, where the 8-foot and 5-foot 6-inch concrete pipe sections join, a large reservoir holding 250,000,000 gallons of water to serve as an equalizing basin and as a safeguard against temporary interruption of flow from Shoal lake, should this be necessary to permit repairs or cleaning of the aqueduct.

The natural ground level at the site chosen for this large reservoir is at an average elevation of about 774.5 and the water level will vary in service from 791.0 to 797; in other words, it will stand from 16.5 to 22.5 ft. above the level of the surrounding prairie.

The higher level represents the condition when about 20,000,000 gallons is going by gravity to the McPhillips street reservoir, and the lower when about 115 million gallons daily is leaving the reservoir and is distributed to the various communities forming the water district, 35 millions going to the bank of Red river by gravity and being boosted thence through the 48-inch pipe line to the McPhillips street reservoir, and the balance being distributed to the city and its associated communities from other points.

In order to properly consider the hydraulic problems involved in the west end of the aqueduct, from the Deacon reservoir to Winnipeg, it will be necessary to say a word about the quantities of water required by the different communities forming the district, the rates at which it must be supplied, and the obligations of the district to its component parts in the matter of purveying the water.

ESSENTIAL CONDITIONS IN GREATER WINNIPEG WATER DISTRICT ACTS

1. The corporation is required to furnish water "in bulk" to the several communities forming the district. The context of the Act discloses that the words "in bulk' mean quantities of water at ground level rather than at city street main pressures. In other words, while the District is not authorized to pump water into the street mains of any of the municipalities, it is commanded to furnish water to any one or all, in such quantities as they may severally or collectively need from time to time, by gravity if possible, and, if not, then by pumping to sufficient head to cause the water to flow from the nearest convenient point on the District's main conduit to the nearest point at the corporate limits of the municipality in question. However, this Act specifically states that the main conduit shall terminate at a point adjacent to the McPhillips street reservoir in Winnipeg.
2. Any municipality having water conveyed to it from the District's main conduit through a special connection and branch conduit, shall pay the District annually half the interest, sinking fund, maintenance and operation costs in respect of plant and construction required to convey water from the main conduit of the corporation to the municipality in question.
3. Any municipality having a system of water mains may deliver water through these, in bulk, to another municipality.
4. The corporation is not required to build a main to deliver water to any municipality when another municipality is willing and able to deliver it an adequate supply, but may be required to later build such a main, if the aforesaid arrangement is terminated.
5. The coporation may bear, in whole or in part, the cost of extending the existing mains of any muncipality to the boundary of another to avoid the cost of direct mains from its work.

The total cost of work under contract and under way in Philadelphia since early January on Municipal improvements, including paving and construction of sewers, bridges and water supply systems, is $7,030,636. This amount covers 278 contracts, 164 of which, totalling $3,638.250, were for paving work. Seventy-two contracts are for sewers and contracts awarded by the Water Bureau total 34.

The Board of Estimate and Apportionment of New York City has appropriated $4,177,000 for motor operated snow removal equipment, for the department of street cleaning.

Immigration Notes

During the second week in June there arrived in New York 9,132 immigrants. Their distribution to their final destination is considerably delayed by lack of facilities which are serious, according to Commissioner Frederick A. E. Wallis, who says that the station at Ellis Island is over-crowded and that "this dragging along with stagnated inspection, overcrowded witness rooms, and the consequent unpardonable delay to aliens who are eager to get to their destinations, must be corrected or we will be swamped by the increasing flow of immigrants."

The literacy test to which these immigrants are submitted consists of reading, in their native language or any other language that they may choose, 30 or 40 words from the psalms. A large number of different verses are printed separately, in all languages, on cards that are used by the inspectors in such a way as to prevent fraud by memorizing verses previously given out.

Scores of colonies of Mennonites, discouraged by the severe climate in Manitoba and Saskatchewan, Canada, having an estimated total of about 8,000, are immigrating rapidly to the lower Mississippi valley.

Notwithstanding the heavy draft required to support the standing armies still maintained in Europe, an increasing number of their working men are immigrating to this country, and the accessions to labor here are important, though far less than the pre-war ratio. The passport laws compel the prospective immigrants to obtain the visé of the American consul nearest his residence and also of the American consul at the port of embarkation; restrictions which, while somewhat reducing the number of immigrants, undoubtedly tend to secure a much better class. Most of them come, it is said, with a direct objective, such as to join friends or relatives already settled here, and much good could be accomplished by a competent, disinterested organization that would instruct and persuade and assist these immigrants to locate at those points and in those industries where they are most needed.

While construction, agriculture and general industries throughout the country are suffering and pleading for a great amount of labor of all sorts, there appears to be no abatement of the Pacific Coast opposition to Asiatics, and Governor Stevens of California has just addressed a letter to U. S. Secretary of State Colby, in support of the federal initiative of measures to deny Asiatics the right to all land purchases.

The Governor, while disclaiming animosity against the Japanese, does not wish them to settle in California or to develop a Japanese population there. He states that within the last ten years the Japanese population in California has increased from about 41,000 to 87,000 and believes that government action is necessary to prevent them from retaining possession of agricultural lands through personal employment contracts. If the Japanese are not desirable land holders it is still to be proved that they may not be exceedingly efficient and reliable industrial workers, of which we stand in such urgent need.

Since the close of the Revolutionary War 33,000,000 immigrants have entered the United States, and they and their descendants now constitute nearly 50 per cent of our total population. Between 1776 and 1890 there were 6,000,000 British immigrants and 5,125,000 Germans, but since 1890 only 1,023,000 Germans among 17,000,000 immigrants.

According to figures recently published in Ottawa, the immigration into Canada during April and March totaled a little over 24,000, or nearly 3,000 per week, of whom about 47 per cent came from the United States. During the same period the immigration into the United States hardly exceeded 12,000 per week, or only four times as much as that of a country with one-twentieth of the United States' population. If there had been no emigration from the United States to Canada the relative increase in the population of the two countries would still have been about 1 to 8½, or more than twice as great as the ratio of the respective populations.

During the week ending June 19, 10,527 aliens arrived at Ellis Island, New York, including nearly 2,000 reservists, of whom 1,500 were Poles who quit the mining districts of this country two years ago to join the Polish army. These have been inspected, sent to Camp Dix, and discharged. Contrary to the expectation of the immigrant inspectors, the immigrants now arriving are said to be of a noticeably better class than those coming to this country before the war. It is also interesting to note that deportations, which formerly sometimes exceeded 3 per cent of the arrivals, were only 885 out of the 152,987 immigrants received at Ellis Island during February, March, April and May, or only a trifle more than ½ of 1 per cent.

According to the Commonwealth Steel Co., St. Louis, 80 per cent of injuries received by their workmen were among the non-English speaking employees, who constitute only 34 per cent of the force.

K. G. Lober, New York representative of a Copenhagen Company, who arrived on June 22d from Copenhagen, is quoted in the New York *Tribune* as stating that the very serious industrial conditions now existing in Denmark are due to the policy of the radical party which has just been deposed from power. He says that the government faced bankruptcy through the law granting strikers 8 per cent of their wages while on strike, and that the workers refused to work more than about 10 or 15 hours per week but demanded and received 7 meals per day.

These conditions finally caused the overthrow of the radical power and the organization of the Danish Helpful Service, whose members immediately began the operation of many essential industries that were idle and furnished 300 volunteers, including bankers, lawyers, engineers and teachers, who worked all departments of the steamship Frederick VIII, just arrived from Copenhagen.

Recent Legal Decisions

MATERIALMEN'S LIEN FOR MATERIAL USED IN SEWER CONSTRUCTION

The Wisconsin Supreme Court holds, Worden Allen Co. v. Wisconsin Tunnel & Construction Co., 176 N. W. 877, that a sewer is machinery under the Wisconsin statute of 1917, section 3328, giving a materialman a lien for material used in the construction, repair, or removal of any building or machinery. In a materialman's proceeding against a city to recover for material furnished for the construction of a sewer the fact that part of the materials were turned over by the municipal contractor to another subcontractor did not deprive the materialman of his right to a lien, where the material was actually used in the construction of the sewer.

MATERIALMAN'S CLAIM AGAINST CONTRACTOR'S SURETY —EFFORTS TO COLLECT DEBT

The Oregon Supreme Court holds, City of Pendleton v. Jeffrey & Bufton, 188 Pac. 176, that under the Oregon statute, L. O. L., section 6266, requiring contractors on public contracts "promptly" to pay materialmen, a contractor's surety was obligated to pay such bills at maturity. The materialman's efforts to collect the amount due from the contractor by prosecuting the contractor's claim against the owner, foreclosing a mortgage assigned to it by the contractor, etc., did not release the surety for the remaining balance, where the latter had been kept informed of the materialman's efforts to collect the debt.

CONTRACT FOR SEA WALL HELD INDIVISIBLE MAKING CONTRACTOR LIABLE TO REPLACE PART DAMAGED BY STORM

The Connecticut Supreme Court of Errors holds, City of Bridgeport v. Scott, 109 Atl. 162, that a contract to construct a sea wall for a city involving excavation, masonry work, the use of concrete, the placing of riprap on the seaward side, the driving of piles, etc., payment to be determined on the basis of unit prices for each cubic yard of excavation, fill, cement masonry, etc., is an entire contract though the amount was left for ascertainment on the price basis and though the contract provided for payment by installments as the work progressed. The contractor could not, therefore, escape liability to replace a completed portion of the wall, damaged by a storm, on the theory that the contract was divisible.

SUBSTANTIAL PERFORMANCE OF CONTRACT FOR SEWAGE DISPOSAL PLANT

Action was brought for a balance due on a contract for the erection of a sewage disposal works in a borough, alleging substantial performance, and also for extra work and other items arising incidentally out of the performance, including increased cost from mistake in location and elevation of the works, excavations not contemplated and expense of maintenance of plant after completion and notice. The trial court on disputed facts directed a verdict for the borough. The New Jersey Court of Errors and Appeals holds, Braunworth v. Borough of Verona, 109 Atl. 343, that the question of substantial performance of the contract, as well as the defendant's liability under the contract for extra work and the other items involved, was for the jury, and reversed the judgment.

CALLS FOR UNIT PRICES FOR CONTINGENT EXTRAS AND WORK FOR WHICH NO UNIT PRICES ARE PROVIDED

A municipality advertised for proposals for lump sum bids for a sewage disposal plant complete, as per plans and specifications, and also unit price bids for contingent extras, work for which unit prices were not provided to be done for actual cost plus 15 per cent. The lowest bidder was awarded the contract. While he was in the midst of the work and the foundation which had been called for originally was nearly completed, the borough decided it to be unsafe to bear the burden proposed to be placed on it, and passed a resolution that the contractor be authorized and required to do certain work for which no unit prices were provided, the total cost of which proved to be far in excess of $500. After this work was practically completed, the borough stopped all work, and later ordered the contractor off the job. The contractor sued for payment for extras, delays caused by the borough, the maintenance of his plant and force on the job while idle, and the value of materials not incorporated in the work.

The New Jersey statute, P. L. 1912, p. 596, provides that whenever it shall be lawful for a public body to let contracts for doing work or furnishing materials or labor, where the sum to be expended exceeds $500, the action of such public body in entering into any such contract shall be invalid, unless there shall first be public advertising for bids and awards made to the lowest bidder. The New Jersey Court of Errors and Appeals holds, Ippolito v. Borough of Ridgefield, 109 Atl. 337, that there is nothing in that statute which forbids a call for unit prices for contingent extras and the doing of other work for which unit prices are not provided for cost plus 15 per cent. The insertion of such provisions in a contract is a protective measure to the public in the event of modification of the work caused by an unforseen emergency or as an incident to the work provided for in the original contract. The municipality is always protected, because whether this is so or whether the extra work is the result of an effort to evade the statute, are questions for the jury. Nonsuit was therefore reversed.

SUBCONTRACTORS, ABANDONING CONTRACT FOR CONTRACTOR'S DELAY, CAN SHOW CHANGED LABOR CONDITIONS

In an action for breach of contract by the general contractor for the erection of a postoffice building against the subcontractor for all the labor and material necessary to complete the building except pile driving and excavation, it appeared that it was contemplated by the subcontract that work thereunder was to commence within a reasonable time after a certain date. The subcontractor repudiated the subcontract because of the general contractor's unreasonable delay in having the piling and foundation in proper shape for commencement of work by the subcontractor. It was held, Interstate Constr. Co. v. U. S. Fidelity, etc., Co., Michigan Supreme Court, 174 N. W. 173, that the subcontractor could show in the action that the changed labor conditions caused by the general contractor's unwarranted delay would have imposed an extraordinary and unwarranted burden on the subcontractor. Under the subcontract the general contractor was held under obligation to do the pile driving, pit digging and pile cutting before the subcontractor was obliged to perform the part of the work covered by the subcontract, as certainly as if the obligation had been so definitely expressed in the subcontract.

INACCURATE USE OF LANGUAGE IN FRAMING CONTRACTOR'S CLAIM

The contractor for the construction of a sewerage system for a borough was refused permission to complete the contract, the borough forcibly stopping the work. The contractor sued for damages and recovered a verdict and judgment. On appeal the borough contended that the contractor had "rescinded" the contract, and therefore could not recover under it. The contractor's notice to the borough on its breach of the contract read: "We consent to a rescission of the said contract and notify you that we do rescind for the above reasons. We demand that you give payment to us of all moneys due to date for work, labor and materials furnished to you under and pursuant to the terms of the contract at the rates mentioned in said contract." The New Jersey Court of Errors and Appeals holds, Cavanagh v. Bor. of Ridgefield, 109 Att. 515, that it is plain the contractor did not intend legal and technical rescission. The notice was in effect that, because of default on the part of the borough, the contractor would no longer attempt to proceed with the contract, but would hold the borough for moneys due under the contract. The language used was inapt, but the contract and attendant circumstances showed that what the contractor meant was in effect "you have stopped us and refuse to pay; very well, we submit, but claim for what we have done." This was not technically a rescission of the contract, but merely an acceptance of the situation which, as the jury must have found, was brought about by the fault of the borough. Judgment for the contractor was therefore affirmed.

SURETY MUST SHOW THAT CHANGE IN CONTRACT ALTERS COST

A contractor for street paving defaulted after giving surety bond and the city readvertised and awarded the contract to another. The contracts were alike, except that in the first the binder was to contain bitumen in quantity from three to five per cent. of the mixture, and the second from four to six per cent. of the mixture. The price in the latter contract was higher. The city sued the surety for the loss it suffered, and obtained verdict and judgment. The Pennsylvania Supreme Court holds, City of Philadelphia v. Ray, 109 Att. 689, that as the evidence did not show that at the time the change in the contract was made it resulted in an increase of cost, the trial court would not have been warranted in directing a verdict for the surety, and the judgment was affirmed.

CITY ENGINEER AS ARBITER UNDER CONTRACT AS TO EXCAVATION

Where the parties to a construction contract agree to abide by the decision of an engineer or architect having the supervision of the work, as to the amount and quality of work to be done and paid for, his decision is binding upon the parties unless it was based on fraud, dishonesty, or collusion. The Ohio Supreme Court holds, Fred. R. Jones Co. v. Fath, 126 N. E. 878, that the mere fact of disagreement between the representative of a subcontractor and the city engineer as to the quantity of excavation, and a settlement on his basis to relieve the city from liability to suit, which settlement the contractor accepted because of fear that the city would exact a penalty for not completing the work on time, is no evidence of fraud or bad faith on the part of the city engineer.

EXTENSION OF TIME—INJUNCTION OBTAINED BY CONTRACTOR

Under a provision authorizing the extension of the time for completion of a paving contract if the work should be delayed by an injunction, the Kansas City Court of Appeals holds, Williams v. Van Deusen, 219 S. W. 395, that the contractor cannot rely upon an injunction pronounced at his own instance and claim credit for the time caused by the delay arising therefrom. In Mc. Leod v. Genius, 31 Neb. 1, 47 N. W. 473, a building contractor was not given the benefit of time covered by a strike of his employees which was caused by his own wrongful and voluntary act. And in Mahoney v. Smith, 132 App. Div. 291, 116 N. Y. Supp. 1091, a voluntary lock-out by a contractor against his employees was held to be no valid excuse for failure to complete his work within the contract time, even though there was a clause in the contract making a strike a valid excuse for delay.

STREET PAVING TAX BILLS—PERFORMANCE OF WORK

In a proceeding by a paving contractor's assignee for mandamus to compel the city to issue tax bills for street paving, which the city refused to do because of defective work, the Missouri Supreme Court held, State v. Dickey, 219 S. W. 363, that mandamus would not lie where it was doubtful whether the contract had been performed, and the surety had failed to remedy the defects.

INTERFERENCE WITH CONTRACTOR ON PUBLIC WORK BY GOVERNMENT

The Circuit Court of Appeals, Eighth Circuit, holds, Sims, v. United States, 263 Fed. 48, that provisions of a government contract for building a levee that damage or injury to any part of the work before acceptance should be repaired by the contractor at his expense, did not require him to rebuild at his expense parts destroyed by flood and caused by acts of the government officer, who had, without warrant in the contract, taken temporary possession and excluded the contractor.

NEWS OF THE SOCIETIES

July 26-30 — INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS. Annual convention, Toronto, Canada. Secretary, Stephen E. Hoey, Municipal Bldg., New York.

Aug. 30-Sept. 3.- AMERICAN PUBLIC HEALTH ASSOCIATIION. San Francisco. Office of secretary.

Sept. 7-16.—NEW ENGLAND WATER WORKS ASSCOCIATION. Annual convention, Holyoke, Mass. Secretary, Frank J. Gifford, 715 Tremont Temple, Boston, Mass.

Sept. 13-17 — AMERICAN PUBLIC HEALTH ASSOCIATION. Boston, Massachusetts.

Sept. 13-17 — AMERICAN PUBLIC HEALTH ASSOCIATION. Annual convention, San Francisco, Cal.

Sept. 13-17 — SOUTHWESTERN WATER WORKS ASSOCIATIION. Annual convention, St. Charles Hotel, New Orleans, La. Secrtary, E. L. Fulkerson, Waco, Texas.

Sept. 20-23 — SOUTHWESTERN WATER WORKS ASSOCIATION. Annual convention, St. Charles Hotel, New Orleans, La. Secretary, E. L. Fulkerson, Waco, Texas.

Oct. 12-14.—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. St. Louis, Mo. Secretary, Charles Carroll Brown, 401 Lincoln Avenue, Valparaiso, Ill.

LOCAL ASSOCIATION OF AMERICAN SOCIETY OF CIVIL ENGINEERS

Southern California Association.

Organized 1914. W. K. Barnard, president; Floyd G. Dessery, secretary, 514 Central Building, Los Angeles, Cal.

The Southern California Association of members of the American Society of Civil Engineers (Los Angeles, Cal.) holds regular monthly meetings on the second Wednesday of each month, the December meeting being the annual meeting.

Informal luncheons in connection with the Joint Technical Societies of Los Angeles are held at 12.15 p. m. every Thursday at the Broadway Department Store Cafe.

Spokane Association. Organized 1914. Alfred D. Butler, president; Charles E. Davis, secretary-treasurer, 401 City Hall, Spokane, Wash.

The regular meetings of the association are held on the second Friday of each month, except July and August.

Texas Association. Organized 1913. Hans Helland, president; E. N. Noyes, secretary, Deere Building, Dallas, Tex.

AMERICAN ENGINEERING COUNCIL

At its regular meeting June 17, 1920, after hearing a report on the Organization Conference, Engineering Council took the following actions:

"Voted: That Engineering Council heartily endorse the plan of organization of the Federated American Engineering Societies and the American Engineering Council, adopted by the organizing conference of technical societies in Washington June 3 and 4, and authorize its executive committee to proffer and perform on the part of council such assistance as may be practicable in completing the work of the Organizing Conference and of the Joint Conference Committee of the Founder Societies in establishing the American Engineering Council.

"Voted: That Engineering Council authorize its Executive Committee to deal with any question of co-operation with the Joint Conference Committee of the Founder Societies, relating to the permanent organization of the Federated American Engineering Societies, which may come up during the summer.

"Voted: That the secretary be instructed to invite to future meetings of Engineering Council delegates of the societies participating in the Organizing Conference in Washington, June 3 and 4, and editors of technical journals who may be interested"

CANADIAN INDUSTRIAL COUNCIL

The Industrial Conditions Act ot Manitoba, enacted as a result of Winnipeg strikes, provides a joint council consisting of five members with one ex-officio judge; two representing employers, two employees, and one appointed by Governor to represent public. The council investigates all matters connected with industrial conditions, including cost of living, unemployment, unfair profits and unfair wages. The right of employees to bargain collectively is recognized and the sacredness of contracts is insisted on.

NEW YORK SECTION AMERICAN SOCIETY OF CIVIL ENGINEERS

At the annual meeting of the New York section, American Society ot Civil Engineers, May 12, William J. Wilgus presented a paper on the railroad problems in relation to the metropolitan district, dealing with an immediate solution of the nation's railroad problem as the first consideration. It considered New York as the world's principal gateway to the United States and "the terminal sore spot" of the nation, and showed that the separation of New York City from the mainland is the principal cause of an intolerable situation, while the narrow piers without tracks, trains and motor-truck driveways are cause for excessive terminal costs and delays.

An outer beltline was suggested for linking New York City, other than Manhattan, with the mainland, and unification and electrification of the terminal zone, and the modernizing of the water-front were recommended as corollaries of the outer beltline.

Diffusion of terminals and markets, and store-door collections and deliveries were suggested for Manhattan, and Stapleton, Saten Island, was presented as an ideal location for modern port development. A continued failure to do anything to meet the situation constitutes an imminent danger to the community.

THE WESTERN SOCIETY OF ENGINEERS

At a regular meeting held June 21, the Western Society of Engineers, discussed a paper presented by L. Condron, on State Registration of Engineers which called attention to the lack of uniformity of rights and the responsibilities of engineers engaged in interstate practice and for the necessity of experience and attainments rather than high examination marks.

NEW HAMPSHIRE GOOD ROADS ASSOCIATION

The quarterly meeting of the New Hampshire Good Roads Association was held at Franklin, N. H., June 10th. The principal subjects discussed were snow plows and snow removers and the clearances of overhead bridges. A resolution protesting against the embargo on road construction materials was passed and copies were ordered to be forwarded to the state senators and congressmen. French roads and road-building were discussed by returned officers of the American Expeditionary Force that respectively applauded the superior excellence of French roads and the superiority of American road-building methods. The program included luncheon and an automobile over a section of the recently improved Hanover Road to Webster Lake.

MASSACHUSETTS HIGHWAY ASSOCIATION

The summer field day of the Massachusetts Highway Association at Quincy and at Nantasket Beach included a visit to the Squantum Works, luncheon, a trip through the Fall River Ship Works, addresses from a number of prominent men and a typical shore dinner accompanied by an elaborate cabaret show.

During 7 weeks in May and June, the Massachusetts State Department of Public Highways, has awarded five important contracts aggregating nearly $550,000,000 for cement concrete, bituminous concrete, and bituminous macadam roads.

SOCIETY OF MUNICIPAL ENGINEERS OF PHILADELPHIA

At its June 23rd meeting, the Society of Muncipal Engineers of Philadelphia elected as president, Frank E. Maize; vice-presidents, Charles Frommer, James S. Shute and Seth M. Van Loan; secretary, Chas. H. Stevens; treasurer, William J. Logan.

NASHVILLE ENGINEERING ASSOCIATION

A special committee of the Nashville, Tenn., Engineering Association has been appointed to raise an endowment fund of $500,000 for the engineering department of Vanderbilt University and to secure $10,000 for the purchase of machinery for the engineering laboratory there. At the present time suitable machinery can be bought from the United States government for a discount of 15 per cent less than cost and it is hoped that the city of Nashville will contribute $200,00 of the required endowment.

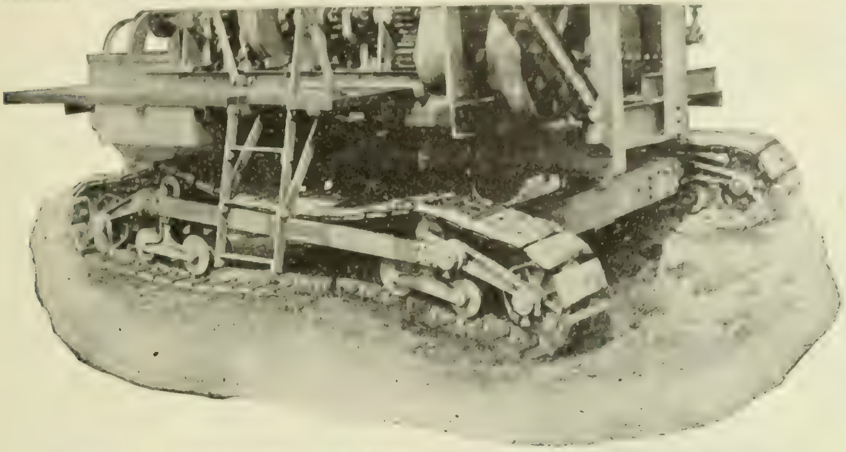
New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

RANSOME NEW CONCRETE PAVER TRACTION

The new 21-foot (wet mixed) Ransome paver weighs 22,000 pounds and can proceed almost anywhere under its own power, over very irregular or soft ground at a speed of ½ mile per hour forward or reverse, can move over the subgrade or the finished surface of any highway under construction without requiring any track laying, whenever there is steam in the boiler to operate the engine that drives the mixer, and the Marion crawler traction with a 10 foot x 13 inch bearing surface on each side of the machine that reduces the ground pressure to 10 pounds per square foot.

The mounted axles are equalizing levers, the outer ends of which carry the crawler driver. The inner ends carry a pair of rollers, that in turn are attached to an equalizing lever. This gives an equal distribution of weight over the sprocket, and the two carrying rollers in each group regardless of any unevenness of the ground.



CRAWLER TRACTION WITH EQUALIZING DISTRIBUTION OF WEIGHT

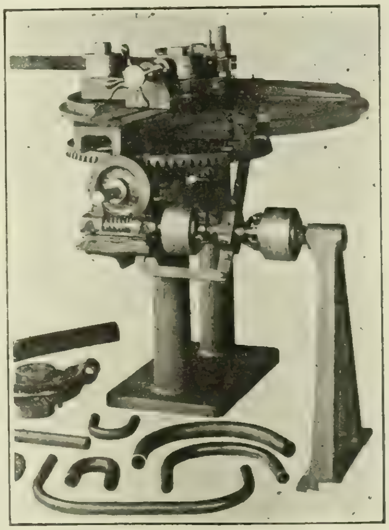
PIPE BENDING MACHINE

A power driven pipe bending machine with capacity up to pipes of an outside diameter of 2.375 inches has been put on the market by the Wallace Supplies Manufacturing Company. With it and the equipment shown in the illustration (where the small figure at the base is an additional forming head designed for 1-inch standard pipe) bends can be made cold, without the use of an inside follower, or floating mandrel, on pipe 1 inch, 1½ inches, 1¼ inches and 2 inches in inside diameter through an arc of 90 degrees to a radius of 6 to 14 inches. Special forms and inside follower bars can be provided to suit specifications.

The outside follower bar operates between the tube and the roller in such a way as to support the tube for a greater distance and obviate the depression which otherwise generally shows on the tube when the roller operates directly on the material.

The roller bracket is adjustable for forms up to 15 inches diameter and has a narrow screw adjustment to force the tube into the form and to hold the follower bar close to it. The machine is operated by levers for forward and reverse friction clutch pulleys with adjustable stops to suit any degree of bend required.

Tubes 1 inch in diameter with walls of 1-32 and 1-16 inch thickness can be bent with inside follower bars and outside follower bars to radius of 6 and 4 inches, respectively, and heavier tubes can be bent with the outside follower bar only. The addition of special equipment provides for easily transforming the machine for bending.



MACHINE FOR BENDING PIPE FROM 1 TO 2 INCHES IN DIAMETER

INDUSTRIAL NOTES

PROFITABLE MOTOR TRUCKS

A United States Motor Truck Company's model H 2½ ton truck was used three years for building roads in Mississippi, for hauling cotton seed and for service as a farm tractor with a very low rate of gasoline and oil consumption and a total bill of only $27.50 for upkeep. The owner was so much pleased that he secured the agency and has disposed of a number of this kind of trucks in his territory.

In another part of the same state a contractor built during last year 75 miles of gravel roadway with seven motor trucks, four of which were of the U. S. type, averaging 100 miles per day on 1 pint of gasoline per mile. The trucks were fitted with U. S. steel bodies having automatic tail gate release and spreading device, each of which saved the work of 4 men. The contractor figured that each truck did the work of 8 teams at one-quarter of the cost. The average cost for inspection and repairs for the season was $48.39 per truck.

LIME IN CONCRETE AND MORTAR

The National Lime Association has issued bulletin No. 303 entitled, "Test Data on Lime in Concrete and Mortar," a study of tests and experiments on the effects of hydrated lime when added to concrete mixtures under varying conditions and for varying purposes, together with comments and field observations, by T. B. Shertzer.

The pamphlet has 17 pages, illustrated, and gives data of tension tests conducted by the Chief of Engineers, U. S. Army, compression tests conducted by the H. M. Spackman Engineering Company Laboratory, beam tests conducted at the Pennsylvania State College, salt water tests made by the Dravo Construction Company at Sparrows Point, Maryland, watertight tests made by Sanford E. Thompson, Boston, tests on brick mortar and brick piers by Prof. J. S. Macgregor of Columbia University, and reports on their use on hydrated lime from a number of prominent engineers and contractors. This bulletin, together with a number of others referring to the use of lime in construction work will be sent free on application to the National Lime Association, Washington, D. C.

ELECTRO BLEACHING GAS CO.

The Electro Bleaching Gas Company, manufacturers of liquid chlorine, announce that they now have ready for mailing to interested applicants, a reprint from the Journal of the American Waterworks Association of last year, entitled, "Relation of the Chemical Industry at Niagara Falls to the Waterworks." This reprint and discussion forms an 18-page illustrated article by John A. Kienle on the manufacture of chlorine and bleaching powder and on the chlorination of water supplies, with diagrams and other statistics showing the relation of chlorinated water supplies to typhoid death rates.

COMPRESSED AIR DATA

A series of twelve separate and independent chapters on various data connected with the development and application of compressed air to engineering and construction and mechanical operations, have been issued by the Ingersoll-Rand Company, neatly bound by them in a 4¼ x 6¼ flexible, gilt lettered cover, and distributed among engineers and contractors interested in the use of compressed air.

These data are comprehensive and authoritive and give a large amount of reference and detailed information of value in estimating, designing and conducting a large number and variety of important operations, especially in field work such as riveting, chipping, caulking, drilling, boring, tamping and hammering with pneumatic tools and the operation of tripod and jackhammer drills for rock cutting, quarry work and the like, for driving drift bolts or lag screws, for operating hoists and compressed air engines and pumps, for driving foundation piles and sheet piles, for painting and sand-blasting and for many other standard and special operations.

There are descriptions of work completed and of the methods of carrying out various operations, diagrams and instructions for installing equipment, definitions, and explanations, numerous tables of costs data, dimensions and other standard information together with illustrations of standard air tools and machinery and of their application. The book is on heavy calendared paper and contains 240 pages of attractive and well arranged data exclusive of 20 pages of indexing that enables any subject to be easily located.

AMERICAN-LA FRANCE COMPANY

The American-La France Fire Engine Company, Inc., announces the sale during April of pumping engines to 20 different cities, including Manila, P. I., and trucks, cars and other important apparatus to 13 other cities. The above shipments were supplemented by 70 sales of important apparatus during the same period of time

OUTING OF MORRIS KNOWLES' EMPLOYEES

Employees of the organization of Morris Knowles, Inc., engineers, of Pittsburgh, Pa., participated in their regular annual outing June 12th at Wexford Park. Races and a baseball game were features of the afternoon, and many of the 200 employes, their families and friends participated. The ball game was between teams made up from the 12th and 13th floors and the 11th floor of the Jones Bldg., and resulted in a victory to the latter. The feast served at 6:30 by a special committee was laid on tables arranged under the trees. Jazz music was furnished by a local band and dancing continued throughout the evening.

Besides the local attendance there were present R. F. McDowell of the Cleveland Office, W. Wade Shidler of the Youngstown office, and several employees of the Windsor, Ontario, Canada office.

PERSONALS

Butts, C. M., has been appointed chief assistant engineer of Butte County, Cal.

Hanna, Davis, has been appointed superintendent of water works, Windsor, Ont.

Cunningham, Max L., state engineer of the Oklahoma Department of Highways has resigned to become vice-president and chief engineer of the Municipal Excavator Company, Oklahoma City, Okla.

Stayton, Col. E. M., civil engineer, has been appointed member of the Board of Control of the Kansas City Railway Company, representing the city.

Roberts, K. M., civil engineer, has been appointed general manager of the Chamber of Commerce, Beaumont, Texas.

Huntington, P. T., has been appointed city engineer of Chippewa Falls, Wisconsin.

Perring, H. G., has been appointed city engineer of Baltimore, Md.

Smith, R. D., railroad construction engineer, Chicago, died May 14th.

Spratt, T. A., has been appointed superintendent in charge of roads for the Ottawa Suburban Roads Commission.

Brindle, T. S., has been appointed chief engineer of Ohio State Highway Department.

Brandow, E. E., has been appointed bridge engineer Pennsylvania State Highway.

Givan, Albert, has been appointed assistant state engineer, California

Blunt, Grover A., has been appointed county engineer of Dubuque County, La

Dunn, H. L., has been appointed superintendent of street construction at Columbus, Ga.

Barstow, G. F,. has been appointed location engineer of St. Louis County, Minnesota.

Lawyer, Van E., engineer of Schoharie County, New York, has been appointed supervisor in the New York State Highway Department.

Ford, F. L., has been appointed general manager of the Connecticut National Pavements, Inc.

Wright, John B., consulting highway engineer, has been appointed municipal manager of Springfield, Vt.

Wallace, Frank, has been appointed resident engineer of the U. S. Bureau of Public Works at Missoula, Mont.

Boutelle, Geo. J., has been elected city engineer of Chester, Pa.

Meacham, J. C., has been appointed engineer of road construction in Clay District, Marshall County, West Virginia.

Walmsley, J. M., has been appointed road superintendent Montgomery County, Pa.

Johnson, V. D., has been appointed engineer of street construction, Roanoke, Va.

Chapleau, S. J., Civil engineer, has been appointed representativ for Canada on the Board of Control for the construction of the compensating works in St. Mary's River.

Davey, W. B., chief engineer of the Orleans Parish Levee Board, has been appointed city engineer of New Orleans.

Sheridan, C. J., has been appointed deputy engineer of Yonkers, N. Y.

Brown, Fred, has been appointed City engineer of Muskegon, Mich.

Danforth, F. A., topographic engineer, U. S. Geological Survey, has sailed for Hawaii to begin the co-operative topographic survey there.

Williar, Major Harry D., Jr., has been appointed assistant chief engineer of the Maryland State Roads Commission.

Chadwick, E. E., has been elected city engineer of Winana, Minn.

Sweet, C. B., and L. V. Teesdale, have resigned positions in the U. S. Forest Product Laboratory, Madison, Wisc., to investigate commerical methods of seasoning timber in India.

Sydenstricker, J. H., has been appointed road engineer of Monroe County, W. Va.

E. M. Stayton, Lieut.-Col., has been made city representative of the Board of Control of the Kansas City, Missouri, Railways.

Rogers, L. L., has joined the firm of Roger Brothers, roadbuilders, with headquarters at Los Angeles.

Jewell, A. H., has been appointed chief engineer of the Kansas State Board of Health.

Widener, Carl, recently city engineer of Bozeman, Mont., will continue to do work on city improvements.

Palmer, H. E., has been appointed engineer of Wilkin County, Minnesota.

McCamman, James R., has been appointed surveyor of Eaton County, Michigan.

Read, L. C., has been appointed engineer of Sandusky, Mich.

Gregory, J. H., has been appointed service director of Columbus, Ohio.

Duffy, W. H., has been appointed consulting engineer in charge of water works improvement of Columbus.

McAteer, J. J., has been appointed a member of the Passaic Valley Sewerage Commission.

Holway, W. R., has been appointed consulting engineer for water and sewerage works at Tulsa, Okla.

Verharen, A. W., has been appointed city engineer of Helena Montana.

Ryan, Thomas, former superintendent of Water Works of Chicago, died May 31.

Foley, Timothy, a contractor, died at his home in St. Paul, May 25, aged 82.

Broenimann, A. E., a member of the survey staff of the New York State Deep Waterway Commission, died May 29 at Watertown, Wis.

PUBLIC WORKS.

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL AND PUBLIC WORKS" and "CONTRACTING"

Vol. 49 FLORAL PARK, JULY 17, 1920 No. 3

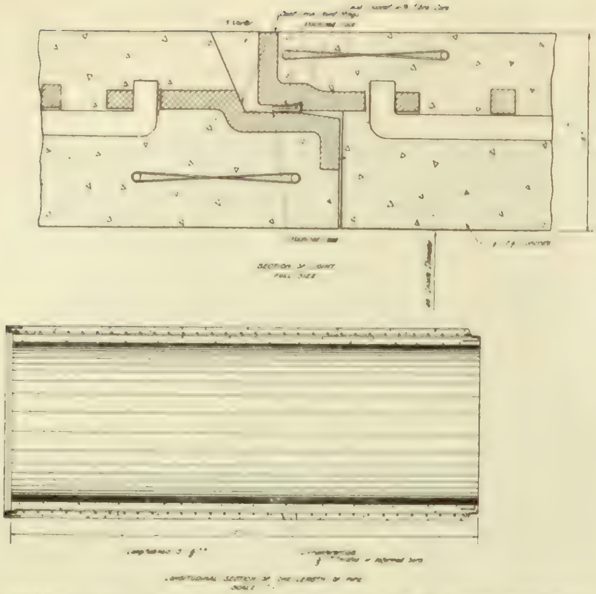
Cumberland's Concrete Water Supply Main

More than a mile of 3-foot pipe shipped 300 miles by railroad and laid in inaccessible crooked trench on the mountainside. Method of manufacture in yard. Special flexible joints tight under 70-foot pressure head. Method of calking joints without impact. Behavior of joints under combined pressure and deflection test

The water supply of the city of Cumberland, Maryland, has been delivered through a wooden stave pipe which, having shown signs of deterioration, has recently been replaced, under the direction of James H. Fuertes, consulting engineer, New York City, by 6,000 feet of reinforced concrete pipe 4 inches thick and 36 inches inside diameter, manufactured by the Lock Joint Pipe Company, Ampere, N. J., shipped about 300 miles to Cumberland, Md., on railroad cars, and installed by the Vang Construction Co., contractors.

The pipe is of the general bell and spigot type manufactured in 12-foot lengths weighing about 6,000 pounds each, and provided throughout with special flexible joints that permit sufficient longitudinal expansion and contraction and transverse deflection to allow the pipe to automatically accommodate itself to curve, grade, and all the ir-

PIPE JOINTED IN TRENCH, TESTED AND IN SERVICE.



STANDARD LENGTH OF PIPE AND JOINT DETAIL.

regularities of location or installation and maintenance without developing leaks or fractures.

This patented joint has recently been introduced and was used for the first time on this installation. It is commercially designated by the manufacturers as their "lead and iron expansion joint."

SPECIAL JOINTS

In each end of each length of pipe there is moulded and securely anchored to the body of the concrete, a cast iron ring previously machine finished over part of its surface. The bell ring is about 4 inches long and the spigot ring 6 inches long, and their combined weight is approximately 230 pounds for the 36-inch pipe.

At the outer end of the bell ring the inner surface is machined for a length of about ¾ of an inch to a true cylindrical surface, beyond which it is tapered for about ⅛ of an inch to a larger diameter, thus forming a groove, having a wedge shape cross-section in the casting with the thin edge of the wedge toward the end of the pipe.

The outer end of the spigot ring is machined, tapering so as to form a truncated cone about 1 inch long, clearing the inner surface of the bell ring. Beyond the conical surface the exterior of the spigot ring is machined to a true cylindrical surface extending to intersection with a shoulder nearly at right angles to it.

When the spigot end of one pipe is assembled in the bell end of another pipe and the joint is completed, the cylindrical part of the spigot ring is opposite the wedge-shape recess in the bell ring, and the space enclosed between the two at this point is tightly filled by a lead gasket which, flowed into the wedge-shaped groove, locks the two pipes together. The clearance between the shoulders of the bell ring and spigot ring is filled solid with cement mortar. The clearance of about ½ inch between the ends of the pipe and that between the tapered end of the spigot ring and the cylindrical end of the bell ring allow for considerable angular displacement between two adjacent lengths of pipe which, together with longitudinal movements of expansion, have been found to take place without impairing the efficiency of the lead calking.

For these joints there has been devised a special gasket consisting of a ring made of lead pipe filled with a fibre core, which in this case was made with ½-inch pipe. The gasket is flattened to a peculiar shape, rolled to the proper circle and the ends soldered together making a ring about ⅜ inch thick and ¾ inch wide.

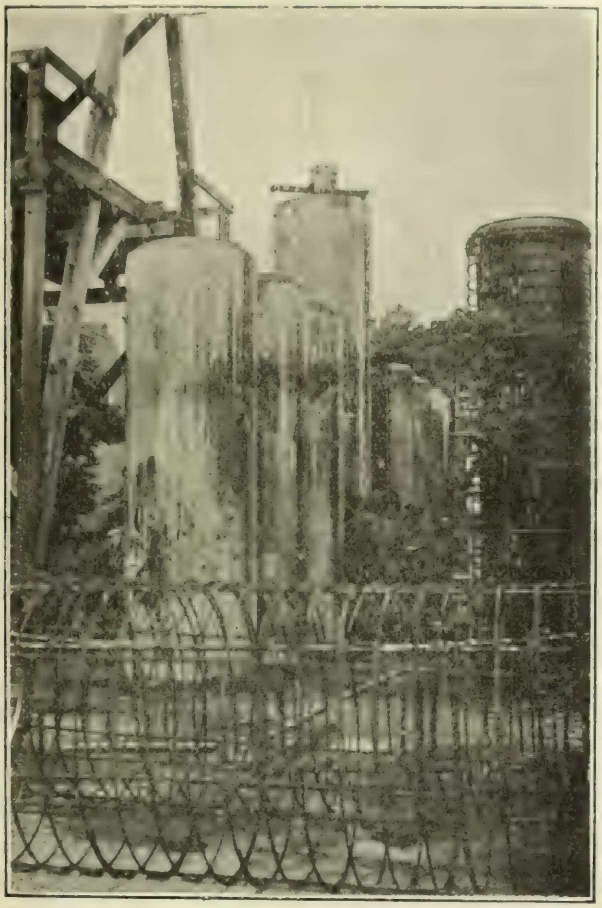
When the pipe is laid the gasket is placed in the groove in the bell, bearing against the shoulder at the rear end of the groove. When the spigot end is inserted in the bell the tapered portion of the spigot ring is centered in the gasket and takes bearing there so that as the pipes are forced together the wedge action of the conical surface develops a heavy pressure against the gasket, causes the lead to flow, and makes a pressure contact for nearly its full width on the machined surfaces of bell and spigot castings. It automatically adjusts itself to any movement or displacement of the pipes and thus forms and maintains a pressure tight joint.

MANUFACTURE OF PIPE

For this work the pipe was manufactured at the headquarters yard of the company at Ampere, N. J., and shipped by rail to Cumberland because the amount of freight involved was not as great as the cost of erecting a local plant for the manufacture of the pipe at the site, as is frequently done. The pipe was cast in vertical collapsible steel forms set on horizontal platforms adjacent to the service track in the casting yard. The interior sheet steel form was put in position and enclosed by the assembled longitudinal and transverse reinforcement bars connected to the bell and spigot joint rings accurately spaced in position. The longitudinal halves of the sheet steel outside form were assembled together around the reinforcement and the 1:1½:2½ concrete was poured into the top of the form from a special conical steel bucket. The flow from the bucket was accurately controlled by a ball valve in the pointed lower end of the bucket which permitted the concrete to be accurately delivered to the narrow annular space between the inner and outer forms. The buckets were handled from a traveling derrick, and after the pipes were sufficiently hardened they were stripped, supported by a special

INSIDE FORMS AND REINFORCEMENT FOR PIPES ASSEMBLED IN CASTING YARD.

adjustable sling suspended from a traveler, and moved by it to the required position and lowered to horizontal position for seasoning on the storage skids whence they were loaded on railroad cars for shipment as required. The contractor's yard is provided with a fabrication shop equipped with machine tools for finishing the joint rings, making forms and bending, cutting and assembling the reinforcement steel.



HANDLING 6-TON PIPE SECTIONS IN CASTING YARD.

The Lock Joint Pipe Company maintains pipe manufacturing yards in twelve states in different parts of the country, enabling large and small water, sewer and culvert pipe to be advantageously manufactured in them and shipped to the site where the bell and the inner soffit, being sheared by the inser- disance transported is not so large as to involve freight charges greater than the saving over some other type of pipe or the cost of establishing local manufacturing plants. The weight of the pipe is approximately 50 per cent greater than that of standard cast iron pipe of the same diameter.

TRENCHING

The difficulty of the work was considerably increased by the fact that the full length of the new line was located on the mountainside in a trench that was absolutely inaccessible except from the end, and in many places the grade was very steep. The inaccessible location prevented the installation of excavating machinery so that the work was all executed by hand.

LOADING PIPE FOR SHIPMENT.

A large quantity of rock was encountered and was removed by hand drilling, blasting, bull pointing and sledging, usually being shoveled or thrown out of the trench by hand. At one point where the maximum depth of the trench reached 18 feet for a length of 200 feet, the excavated material was shoveled into buckets handled by a traveling derrick. The depth of the trench varied between wide limits, in some cases being only half the diameter of the pipe. A trench was excavated entirely in advance of the pipe laying by ten parties located at intermediate points and working for several months.

The pipe was delivered from the railroad to one end of the trench by trucks, from which it was transferred to a temporary service track laid in the bottom of the trench and the pieces taken on it, one at a time, to their required position in the line where they were unloaded and subsequently assembled by the use of an ordinary tripod and hand tackle.

MAKING JOINTS

The pipe lengths were laid spigot end ahead, and each successive pipe length supported in a sling suspended from the laying derrick was held by the derrick until the spigot was entered in the lead gasket in the bell ring and the jointing apparatus was put in operation.

A ¼x10-inch semi-circular steel band having at each end a sheave pivoted to the outside, was fitted to the upper side of the last pipe at the center point. Passing underneath the pipe and through the sheaves in the band, there was led a ⅝-inch chain connected to two horizontal longitudinal bars running along the side of the pipe and passing through a horizontal transverse bearing beam, called a "strongback," bearing diametrically across the end of the pipe length being laid. The threaded ends of the bars were fitted with bronze nuts bearing on washers on the strongback and were turned up with ratchet wrenches.

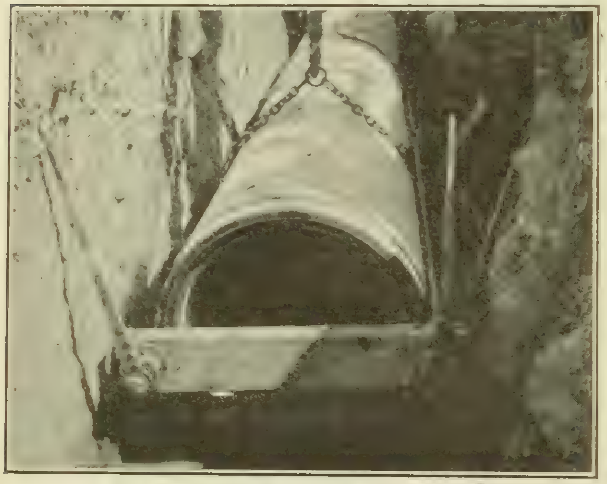
The wrenches were operated to pull the spigot about 1¾ inches into the bell and gasket, and as the spigot advanced, its conical end radially compressed and calked the lead gasket forcing it against the shoulder of the bell and making it completely fill the wedge shaped cavity there.

When the pipe was pulled home the cone end of the spigot had passed beyond the lead gasket and the gasket was fitted tightly between the two concentric cylindrical machined ring faces, the outer circumference of the gasket being anchored to the tion of the spigot cone, formed a very efficient stuffing box, maintaining the tightness while it permitted movement of the pipes.

The elasticity of the fibrous core of the gasket is so great that when the pipe is deflected out of line a considerable spring is developed in the gasket sufficient to be noticeable when the pressure on the gasket is released. The force required to pull together two 36-inch pipes is approximately 25,000 pounds, which suffices for the very satisfactory expansion of the joint lead without mechanical calking and produces a driving fit and pressure contact throughout the whole length of the lead joint; a very important advantage over the ordinary hammered calking, the compression from which penetrates only a very short distance from the surface.

For one 36-inch pipe joint the weight of the lead and fibre core together is only about 10 pounds, while the weight of a standard hammer calked joint of a cast iron pipe of the same diameter is about 70 pounds, and the latter joint requires considerable time and involves expensive work for melting, pouring and hand calking, and does not insure perfect results without testing, repairing and retesting.

The shifting of the derrick from joint to joint by hand took almost as much time as making the joints, so that the crew of six men averaged about 120 feet per day with a maximum of 200 feet, although under ordinary waterworks trench conditions, they should be able to lay and join from 240 to 300 linear feet of 36-inch pipe daily.



MAKING PIPE JOINT IN TRENCH.

The pipe was laid in one section of about 2,500 feet and another of about 3,500 feet, both of which were at the ends connected with the old wooden stave pipe by cast iron elbows. The new pipe was laid parallel and close to the old wooden pipe, necessitating extra time and care to safeguard the latter and avoid permitting the weight of the heavy new pipe to be supported by the wooden pipe.

In order to locate and correct any possible leaks the pipe was put in service before any portion of it had been covered. The water supply for the city of Cumberland was so limited that there was only enough stored for a few hours, when the new pipe was completed, and although it was put under pressure as quickly as possible, no signs of leakage were discovered at any joint by the most careful examination, and no portion of the pipe line required any repairs or modifications.

This record is especially notable in that the 500 joints of the line are the first of this type that were ever installed and their condition was so satisfactory that no test other than the service pressure was required for their acceptance by the owners. The flexibility of the joints permitted the entire line to be composed of horizontal curves, vertical curves, and combined horizontal and vertical curves with a maximum radius of 1,500 feet connected by short and infrequent tangents.

The line has been in constant service since September, 1919, without developing any trouble whatever, and has thus demonstrated the integrity of the pipe and joints under the severe installation conditions and the service pressure of thirty to seventy feet head.

COMBINED PRESSURE AND DEFLECTION TESTS.

The efficiency of the joints under severe working conditions was demonstrated by a test made on five lengths of 36-inch pipes jointed together, bulkheaded and put under a pressure of 40 pounds per square inch. The pipe, 60 feet long, was supported at the ends and was jacked up 1½ inches at the center, causing the two middle joints to open 9/16 inch at the top, and the two outer joints to open 9/16 inch at the bottom.

COMPLETED FLEXIBLE JOINT.

The jack was then lowered 3 inches, reversing the deflection and causing the joint openings to close and corresponding openings to appear on the opposite diameters of the same joints so that the two inner joints were opened 9/16 inch at the bottom and the two outer joints were opened 9/16 at the top.

The pipe was then jacked up to its original horizontal position, causing equal expansion of ¼ inch all around at each joint.

All of these movements were accomplished without any leakage in any of the joints of the pipe, thus demonstrating its ability to stand considerable punishment and to take care of any deflection or settlement that it would ordinarily be subjected to in service.

Water Supplies from the Passaic River

Some weeks ago Montclair, N. J., applied to the State Board of Conservation and Development for permission to obtain a new water supply from Split Rock Pond. This town, together with many others in the vicinity, is now supplied by water obtained from the Passaic river and filtered at little Falls by the East Jersey Water Company. The Passaic river receives the drainage and more or less sewage from a number of small communities above the intake, summer cottage settlements, etc. The treatment of the water, however, is believed to be as nearly perfect as modern developments have made practicable. Jersey City already has a legal right to obtain water from Split Rock Pond, but it is within the power of the Conservation Board to disregard such rights if necessary to make such distribution of the water facilities of the state as most adequately meet the demands of all of the several communities.

The Board has recently announced its decision to deny the request of Montclair, for the reason that the water-shed of which Split Rock Pond forms a part is needed by other municipalities and will in a few years be taxed to its utmost capacity in providing for municipalities within its territory or which already have obtained a legal right to it. The board admits that the pollution of the Passaic river is "so situated and of such character as to be apparent to all who travel the roads in that vicinity and that as a result a strong sentiment exists in the town of Montclair against the use of this water, even after its treatment. The board recognizes that a widespread public sentiment of this character constitutes a natural objection to the use of water thus affected and that where some other source of supply can be obtained without injury to other municipalities and without conflict with the principles controlling the prudent and economical development of the state's water resources, it might safely support the finding of public necessity for the new supply.

"It must be recognized, however, that unlimited supplies of potable water do not exist within reasonable reach of the metropolitan districts; that water supplies ideal in all respects cannot possibly be obtained for all communities of northern New Jersey; and that particularly in view of rapidly increasing population and the comparatively limited water supply sources, it is practically inevitable that so long as the water can be made wholesome and safe the Passaic river must continue to supply a considerable part of that portion of the state."

The board finds that the existing pollution of the Passaic river above the intake could be prevented if proper steps were taken, and that sentimental objection to the supply can better be overcome by removing obvious forms of pollution which are offensive, rather than by abandoning the supply. Also that this water, before treatment, is of better quality than numerous other waters which are successfully treated and safely used for drinking purposes, the stream receiving less sewage effluent, showing lower bacterial count, and draining a region with considerably less pollution per square mile than several of the other approved public water supplies of the state.

"The Little Falls filtration plant is of a highly approved type and efficiently operated, the chlorine gas treatment there employed being recognized as the best form of sterilization in use. The treatment given effectively removes all but occasional and minute traces of pollution. Moverover, the health records of Montclair as well as of all other cities supplied with this water show an exceptionally low typhoid fever death rate and an absence of diseases generally accepted as resulting from the use of impure water."

Delay in Shipments of Materials Used in Purification of Water

Difficulties in transportation have prevented prompt shipment of chlorine, hypochlorite, bauxite, alum, soda ash, copperas, lime, and other materials used in water purification. This has resulted in a very serious menace to life and health, and some epidemics are reported to have been occasioned thereby.

Requests from the state health officers of New York, Michigan, Ohio, Minnesota, Pennsylvania, and Rhode Island have been received by the U. S. Public Health Service for its aid in facilitating shipment. Upon representations by the Surgeon General to the officials of the interstate Commerce quest of the Interstate Commerce Commission that priority be given the shipment of such materials. Personal explanation was made by the Surgeon General to the officials of the Intertsate Commerce Commission and it was clearly stated that these materials are in an entirely different category from other materials for which priority has been requested, because of their direct relation to the prevention of disease and death. In spite of these facts, the Interstate Commerce Commission deems it inadvisable to give general priority to these essentials in public health work, but is willing to act upon requests, giving full particulars, in cases of individual shipments, to use its best efforts to expedite the movement of such shipments.

The following letter from the Director, Bureau of Service, Interstate Commerce Commission, to the Public Health Service, dated June 22, 1920 is self-explanatory:

"The Commission has received your letter of June 17, relative to the urgent need for chemicals used in water purification and for containers for those chemicals.

"The Commissioner has been apprised of the great need for the various materials named in your letter. Innumerable demands have been made upon this Commission for priorities in the furnishing of cars for transportation of commodities, and if your request were granted, it would necessitate similar action with respect to many others. The result would only be additional confusion.

"The Commission has found the better course to be to act upon individual requests for aid that are found to be meritorious. The suggestion was therefore made to the Secretary of the Treasury in response to a request for priority received from him several days ago, and the suggestion is now made to you, that if a statement be furnished, supplemented from time to time, of shipments of chemicals urgently needed at destination, the Commission will be only too glad to do all it consistently can do to expedite the movement of such shipments."

State health officers and others interested are urged, therefore, to send their requests direct to the Interstate Commerce Commission for each individual shipment, giving full particulars, including the name of the railroad and the shipping and destination points.

The Bureau regrets its inability to secure general priority or some other more satisfactory solution than dealing with individual shipments, but after earnest and energetic effort the procedure outlined above is the best that can be secured.

Highway Concreting Method in Iowa

Different methods of hauling materials for concrete roads are being employed by several contractors in the different counties of Iowa. The bulletin of the Iowa Highway Commission briefly describes these as follows:

"The Polk county contractor is planning a central proportioning plant to be located at Saylor for the construction of the Des Moines-Ankeny road. He is installing the derrick alongside the Northwestern tracks. He plans to proportion the aggregate at the plant and to haul the dry batch to the mixer on the grade. His hauling outfit will consist of light trucks carrying one or two batches each. There will be no materials dumped on the sub-grade. The average haul will be approximately two miles; the longest haul being in the neighborhood of four miles.

"It is understood that the Green county contractor has planned to haul the wet mix from a central proportioning plant located in Jefferson. The contractor will operate both the city and county job in connection.

"The O'Brien county contractor, it is understood, contemplated hauling materials on an industrial railway. The gravel will be secured at the east end of the project.

"It is understood that the industrial railway will be used in Palo Alto county, where the county owns a pit and will furnish the material in stock piles at the pit. It is believed that practically all the contractors will make use of the latest up-to-date machine finishing.

"While Iowa road engineers believed for a time that the salvation of Iowa from a road construction standpoint called for the letting of contracts carrying long mileages, there is a tendency to believe now that better progress is going to be made by contracting for the work in short mileages, allowing contractors of smaller means to take on such quantities of work as they can handle. Probably in future lettings the individual sections will be shorter."

The road program of the state of Maine contemplates the expenditure of $4,000,000 and the ultimate completion of an 880 mile system of macadam roads. A $2,000,000 highway bridge from Portsmouth, N. H., to Kittery, Maine, will be opened for bids about August 1.

A new New York State law restricts trucks and trailers operating outside of cities to a width of 8 feet, height of 12 feet 6 inches, and total weight of 25,000 pounds.

Designing Highways for Tractor and Trailer Traffic

At the annual meeting of the National Highway Association in New York City in May, H. Eltinge Breed, consulting highway engineer, read a paper entitled, "The Relation of Highway Design to Tractor and Trailer Traffic," the principal points of which are abstracted in the following paragraphs:

Mr. Breed believes that tractor and trailer traffic is bound to continue and increase. There are registered in the country today 35,000 trailers, and their number has increased more than 100 per cent in the last two years. If this rate of increase should continue until 1930, there would be 500,000 tractors and trailers, but Mr. Breed believes that there will be at least double that number.

One reason for this belief is the pressing need which is met by them. There is a shortage of freight cars all over the country, and even when they are available, railroad haul is more expensive than motor traffic for short hauls. It is calculated that if we combine all costs, such as additional crating, labor, etc., to make a less-than-car-load shipment from Yonkers to New York, the cost averages $1 per 100. The same goods moved by motor truck or tractor and trailer, with the decreased boxing, weight and labor, averages 20 cents. This gives a saving of 80 cents per 100 pounds for a twelve-mile haul in favor of the motor truck. The saving in time, in space for storage and in materials are all in favor of transportation by motor.

The use of trailers makes it possible for one motor truck and one driver to do the work of three trucks and there is a saving in gasoline.

The development of motor transportation, however, suffers a serious check in the uncertainty of highway design. This spring improved roads have gone to pieces as they never have before, an illustration being the Lincoln highway between Trenton and Philadelphia. Some say the damage is due to a hard winter, but Mr. Breed does not believe this. Weather is a natural condition that should not hurt a healthy protected organism, either human or highway. The roads are not designed for the loads they must bear, and unless they are designed to carry the necessary traffic they do not fulfill their function, but hinder rather than help distribution.

Adequate design of highways for tractor and trailer traffic means an immediate provision for three lines of traffic near all the large cities and on all trunk routes, with the possibility of adding 10 feet for a fourth line. At least 9 feet should be allowed for each line of traffic. The additional width is necessary to permit cars going from 12 to 40 miles an hour to pass tractors and trailers moving at a speed of from 6 to 12 miles an hour.

Turns must be widened because of the greater length of the tractor and trailer, and curves must be super-elevated in order that they may keep in their own line of traffic. Reducing grade reduces consumption of gasoline and increases the load that can be hauled, and this saving on main roads heavily traveled often compensates in two or three years for any additional cost involved in reducing grades.

Because of the distribution of the load in several vehicles and because of their slower movement, tractors and trailers are less hard in impact upon a pavement than are heavily loaded trucks. They require no greater strength of foundation or better type of surfacing than should be provided for regular heavy traffic, but all heavy traffic requires an adequate foundation and a durable type of pavement. A semi-durable pavement for heavy traffic is sheer waste.

In the election next November, the state of Missouri will vote on a $60,000,000 bond issue for highway development that has been endorsed both by the State Bankers Association and by the State Federation of Labor.

The citizens of the five counties in Illinois through which the Grant Highway passes, have petitioned Governor Lowden and the state highway officials to resume construction work on the Grant Highway.

Wayne County Concrete Roads

The 1919 report of the Board of County Road Commissioners of Wayne county, Michigan, includes a copy of their specifications for Portland cement concrete pavement from which the following extract should prove of interest to all highway officials, as it represents the best thought of men eminently qualified to write specifications for this type of highway surface:

> "The proportions for the bottom course shall consist of two parts cement; four parts of fine aggregate; and seven parts coarse aggregate; four inches thick, evenly and thoroughly mixed—parts of cement, fine aggregate, and coarse aggregate, to be determined by measurement. Aggregate for wearing course shall consist of: hard, tough, durable, crushed granite or trap rock—with a French co-efficient of wear of at least 16, graded in size, free from dust, loam, vegetable, or other deleterious matter and shall contain no soft, flat, or elongated particles. The size of the coarse aggregate shall be such as to pass a 1¼ inch round opening; and be retained on a screen having one-fourth inch opening. In no case shall the coarse aggregate contain frost or lumps of frozen material. The wearing course shall be mixed in the manner hereinbefore specified, in the proportion of two parts cement, three parts fine aggregate, and five parts coarse aggregate—three inches thick. The wearing course shall be placed immediately after mixing; and in no case shall more than thirty minues elapse between the time the concrete for the base has been mixed and placed, and the time the wearing course is placed."

Wayne County has been recognized during the last thirteen years as one of the greatest pioneers in the construction of cement concrete roads on a large scale. During this period, it has been fortunate in having its highway construction program supervised by a board whose personnel has not been frequently changed and in having the services for the greater portion of this period of Edward N. Hines, who is much interested in the development of the county road system and who has given it much thought.

With experience extending over such a period in the construction of about 180 miles of concrete highway using various widths, thicknesses, proportions of mixture and character of aggregate, as well as contending with varying conditions of soil and traffic, the conclusions of Mr. Hines and his associates as to the best type of cement concrete road construction should have great weight with others engaged in the design and construction of highway surfaces. This is substantiated by the report which states that the development of their road improvement policy has been along sound lines and that "everywhere other counties and entire states have turned to or are looking to our type of construction and our methods as the only real solution of their highway problems."

The significant features of the extracts from specifications quoted above which will immediately impress themselves upon engineers unfamiliar with Wayne county practice are that the specification is for a two-course pavement; that the aggregate for wearing surface is required to be a "hard, tough, durable crushed granite or trap rock, with a French co-efficient of wear of at least 16; that the base course consists of four inches of a 1:2:3½ mixture and the wearing surface of three inches of 1:1½:2½ mixture.

Of the 246 tests of road-building rock from 36 states made by the Bureau of Public Roads during 1919, only 17 of the samples would have complied with the Wayne county specifications. If the officials of Wayne county, after such unusual opportunities for observation and analysis, consider such rigid requirements for aggregate and such richness of mixture essential to the success of the cement concrete pavement, it seems pertinent to inquire what results may be expected in states where such aggregates are not obtainable and where the consideration of economy has resulted in far leaner mixtures and in many cases a lesser thickness.

Are the many cement concrete roads being built five and six inches thick, of a 1:2:4 mixture, and with an aggregate offering only one-third to one-half the resistance to impact and abrasion specified by Wayne county, doomed to certain and early failure? If Wayne county practice is correct, this is not an illogical conclusion.

New Highway Commission for New Jersey

On June 30th Governor Edwards removed from office the five members of the New Jersey State Highway Commission and appointed a new commission, at the same time calling a special session of the State Senate for July 27th to consider for confirmation the appointments made.

On July 1st the new commission organized, with George L. Burton of South River as chairman, and chose Thomas J. Wasser, county engineer of Hudson County, as state highway engineer, with a salary of $10,000 a year.

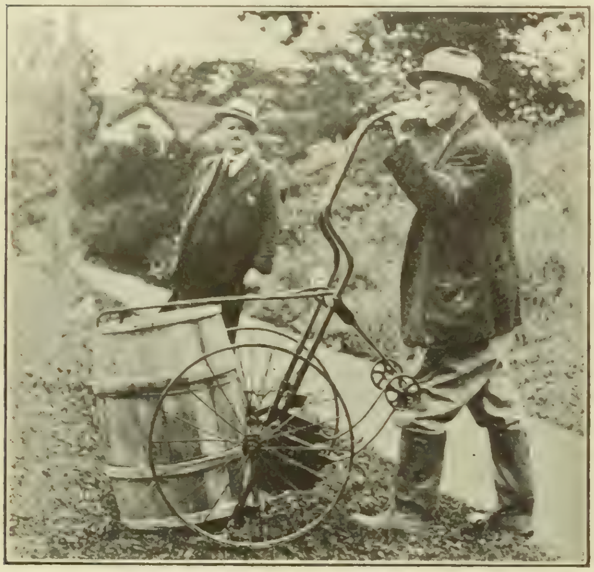
Governor Edwards, in a communication to the new board, strongly urged that they provide for a meeting of the commission each week during the period of active construction, and that the relations between the State Highway Commission and the Counties be so definitely determined that there will be at all times a cordial cooperation rather than a series of disputes, such as the Governor understood had served to interfere with highway work in the past.

The city of Omaha, Nebraska, on the first of July took over the plant of the Omaha Gas Company, and will operate it as a muncipal plant. The price was fixed at $4,500,000 by a condemnation court, described in PUBLIC WORKS for April 17.

Rochester Ash Barrel Carrier

By John H. Child*

In Rochester, N. Y., ashes are collected by a gang of nine men and a foreman. Four of the gang, known as "truckers," precede the others and truck out the ash containers from the rear of the premises to the curb. The wheels on the trucks ordinarily used are eight inches in diameter and the trucks have always been more or less unsatisfactory, especially in snow and soft ground.



PICKING UP BARREL WITH CARRIER.

CARRYING ASHES DOWN STEPS.

A new type of carrier has recently been designed by John T. Lynch, of the Department of Public Works. This carrier has wheels 26 inches in diameter, placed 25 inches apart so that the carrier will receive the largest sugar barrel used as an ash container. There are also two smaller wheels 14 inches apart which are particularly useful on narrow walks, on steps and going over bumps. The tires are 1¾ inches wide. The frame is made of ¾-inch pipe and frame and wheels are so located with reference to each other that the load balances well in any position. A rod AB carries a double hook which, dropped over the top of the barrel, is used to tilt it while slipping the heel of the carrier under the barrel, and also holds the barrel on the carrier. The large wheels make it easy to roll the carrier in snow or on soft ground and on steps, and in general the carrier is propelled much more easily than the ordinary one, which is of the type made for use in freight houses and similar work. It also possesses the advantage of making less noise on sidewalks, less ashes are spilled, and there is less danger of accident to the trucker.

In a recent trial under ordinary collecting conditions in a residential district, it was found that the area covered in six full days with the new barrel carriers required eight days with the old kind of carrier. The collection gang (not including teams) consisted of nine men at 45 cents each and one foreman at 46 cents, giving a total cost per hour of $4.51, or $216.48 for 48 hours' work. Sixty-four hours at the same rate would cost $288·64, or a saving of $72.15 per week. As the new carriers cost only $30 each, it is possible to save the price of more than two of them each week.

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*Assistant Engineer, Rochester Bureau of Muncipal Research.

Prompt Payment of Freight Bills Required

U. S. Interstate Commerce Commission has ruled that, beginning July 1st, "responsible shippers" will be allowed ninety-six hours, not including legal holidays or Sundays, in which to arrange for payment of freight charges to railroads; where bills are presented to shipper prior to or at time of delivery of freight, ninety-six hours dates from first 4 P. M. after delivery; where bills are presented subsequent to delivery of freight, ninety-six hours dates from first 4 P. M. following presentation of bill.

Conference of Engineers of New York State

The first conference of city engineers of all the cities in New York State, was held at Jamestown on the afternoon of July 6th in connection with the annual meeting of the New York State Conference of Mayors and Other City Officials. State high way commissioner Frederick S. Greene discussed paving cost and construction and chief engineer Theodore Horton of the State Department spoke on sewerage and sewage disposal problems.

Mr. Horton urged the engineers to have their cities adopt the separate sewer system as soon as possible, as he claimed that such system will be more economical than a combined sanitary and storm water sewer. He criticised the cities for lack of proper maintenance of sewerage systems and disposal works. "I refer not so much to the sewers," he said, "as to the disposal works, which in most cases have been constructed at considerable cost, and the benefits from which in many instances have been largely nullified by careless operation and in some cases absolute neglect. If these disposal works are worth building at all, they are certainly worth operating, and if civic pride and sound business policy are not sufficient incentives to induce proper operation of these works when once built, the State Departments of Health and Conservation are justified in taking suitable action to force it."

A Sewer System for $1.00

The sewerage and sewage treatment plant of Camp Mills, the Long Island army cantonment, was recently sold to the Buffalo House Wrecking & Salvage Company, in connection with the buildings and entire equipment of the camp, and that company has recently turned over the entire sewer plant to the village of Hempstead, Long Island, for the nominal payment of $1.00. Hempstead already has a sewerage system and it is not probable that it will be able to use all of the pipes and other sewer appurtenances of Camp Mills. The sewage treatment plant, however, is adjacent to that of Hempstead village and is said to be excellently designed and constructed, and it is probable that the village will be able to use this and also the pumping station, which is provided with an electric equipment having a capacity of 2,500,000 gallons of sewage a day.

Philadelphia Sewer Contract Abandoned

The Philadelphia Subway Construction Company has been working on a contract totalling a little over $1,000,000 for the construction of a sewage disposal plant in Philadelphia, but recently has refused to complete the work on the plea that it would entail a loss to them of about $2,000,000. The company is bonded for $512,000 and suit may be brought to recover on the bond. The Director of Public Works and the Chief of the Bureau of Surveys have taken over the plant of the contractor.

Garbage Disposal Contract in Litigation

Atlantic City, New Jersey, in November, 1915, entered into a contract with the Farmers Supply and Products Company, whereby this company was to remove all garbage and dead animals from the city until August 31, 1921, for the sum of $195,000; the company furnishing a bond to the amount of one-half of that sum. On April 1, 1919, the company notified the city that it would cease to collect garbage, and since then it has made no collections.

The reason given by the company was that fully 30 per cent of the matter collected by the company from the garbage pails of the citizens was rubbish, consisting of bottles, cans, and refuse matters of all descriptions. The company claims that these matters damaged the machinery in the reduction plant on Crab Island and also that the company was put to an excessive expense for coal to destroy matter which should not have been mixed with the garbage. It also claims that the most valuable garbage was collected by persons who had no authority to do so. It was further claimed that the city officials had agreed to build a canal which would facilitate the passage of scows from the loading station to the reduction plant, but had failed to do so.

In consequence of the failure of the contractors to collect garbage subsequent to April 3rd of last year, the city was forced to enter into a contract with other parties, paying them $215 a day for such disposal. The city brought suit against the company for $250,000 damages caused by the abandonment of the contract, which necessitated making this higher payment for collection. The company has brought a countersuit against the city for $207,000. The former case was tried on July 1st and a verdict rendered of "no cause for action." We are not informed whether or not definite action has been taken in the suit of the company against the city.

Millions Wish to Emigrate to United States

The special correspondent of the *Boston Evening Transcript* cables from Geneva, June 19, that Europe is still overpopulated and that vast numbers of its inhabitants are anxious to emigrate to the United States. He says, in part:

> Millions of European workers are today anxiously and impatiently knocking at America's closed doors for admittance to the promised land of liberty and equal opportunities, to enlist in America's great industrial army.
>
> The careful investigations which I have been making here justify the estimate that from 5,000,000 to 6,0000,000 workers at least are ready to leave Europe at a moment's notice for America if they are given the chance.
>
> Not only is there no labor shortage in Europe in consequence of the war, but there is in many countries an acute crisis of unemployment. In eastern Europe economic distress is so great that it outweighs national objections to emigration even among the nations that have regained their ancient freedom. Europe is suffering more acutely from the effects of overpopulation today than it did in the years before the great war.
>
> European governments for some time have been aware of the surprising and alarming circumstance that Europe, after losing millions of men in battle, is still dangerously overpopulated, and far from discouraging or attempting to place restriction on emigration to America, as it was at first expected they would do, they are anxious to facilitate it as much as possible.
>
> A prominent Italian government official, with whom I discussed this problem recently, expressed the Italian point of view as follows:
>
> "More than ever before, emigration is a vital question for Italy today. The chief cause of the unrest that is prevailing in Italy is due to unemployment. It is the most natural and excusable form of labor unrest, and has no connection with bolshevism, although bolshevism is undoubtedly seeking to exploit it for its own anarchic ends. Thousands of honest Italian workers, who returned from America to Italy during the war to fight for their country, have been waiting vainly for many months for permission to go back to the United States and do their old work. The Italian government, which at first committed the common error of believing that it would be necessary to restrict emigration after the war, has been negotiating for a long time with the authorities at Washington in order to get the existing American restrictions on immigration modified in favor of Italian workers, but unfortunately it seems that these negotiations are not leading anywhere."
>
> What is true of Italy applies in a large measure also to the countries of eastern Europe, where there is not only unemployment, but famine, pestilence and war. For over a year there has been a great westward movement of emigrants in Europe from Russia, Poland, Rumania and the Ukraine. Hundreds of thousands of these emigrants

have stuck fast in Germany and Austria, because they were unable to get any farther and above all to reach America, still the land of their dreams. The anti-Semitic wave that is sweeping over the Russian border countries has swelled the ranks of these eastern emigrants, many of whom are Jews. They are unwelcome in Germany and Austria, where their presence serves to aggravate economic distress and where anti-semitic feeling is also already running very high. But farther west in Europe they cannot go, at least not in great numbers, and they are a serious menace to reconstruction where they are.

Precautions America will certainly have to take if she decides to abolish existing restrictions on immigration before it is too late, but they should be rather medical than political in character. There is a very real danger that foreign labor might bring foreign pestilences with it to America at present. All kinds of epidemics are raging in the countries of eastern Europe. The reorganization of American quarantine stations on modern lines, particularly as regards disinfection preventing the introduction of typhus, must be effected before America opens wide her gates, as Europe hopes she will at last.

Emigration to Canada

Emigration to Canada is expected to receive a great impetus during the present season through the efforts of the Western Canada Colonization Association which has already raised a large part of the $1,500,000 fund required to bring 50,000 5-person families from the United States These, with 70,000 families from Europe, are wanted to settte 20,000,000 acres of idle land lying between parallel, railway lines.

This association estimates that each settler is worth $746 per year to the railroads alone, and the program is to make it so attractive and profitable to the settlers that at least 75,000 more families will soon come independently from the United States to join the 50,000 secured by the present campaign.

If this program is carried out it will be worth while not only to find a means of replacing, two to one, the emigrants from the United States, but to also discover and emulate the means by which the Canadians make so attractive farming that has ceased to hold a large percentage of the laboring class in this country.

More Plentiful Farm Labor

Reports from Ponta City, Oklahoma, state that the Wheat Belt of Oklahoma is surfeited with labor. "There are three men for every job in the harvest field."

Similarly Kansas city reports that "The Labor situation throughout the West has changed entirely. There is more labor here seeking employment than there is employment. Idle men are in evidence almost anywhere. This condition is having its effect on railroad labor in the west and all are trying to do better so that they may hold their jobs. We are coming rapidly to the point where there is too much labor for the work to be done."

The above is "Interesting if True," and it is most earnestly to be hoped that it not only is true, but that it will remain true, and that the good effects be not impaired by suicidal strikes created by radicals and intended to force artificial and impossible standards of hours and wages. Reports are already beginning to indicate that the impossible wages demanded have caused such a reduction of construction that many workers are out of employment and despite their nominal high wages, are receiving smaller total sums and will be glad soon to work for reasonable prices and to give a more honest equivalent for their pay. This condition will of course obtain in the end, but the amount of damage that can precede it is still enormous.

Japanese Labor

During the year just passed, the emigration from Japan to the United States has averaged about 1,000 persons per month, of whom nearly one-half were women. These are admitted under the "Gentleman's Agreement," besides which an unknown but relatively small number have made illegal entry into this country. Considering that the deficiency in labor is continually increasing, and it now estimated as high as 4,000,000 or 5,000,000, it would seem well to have this number of Japanese immigrants very greatly increased by reducing the restrictions, at least for several years.

During recent weeks, the immigration of Mexican labor into the United States has been at the rate of about 1,000 per week until it was stopped by the orders issued June 25 to Mexican officials.

On July 1st, the price of Portland cement at St. Paul and Minneapolis changed from $2.37 to $2.52.

General Marshall Appointed Manager of the Associated General Contractors

The executived board of the Associated General Contractors of America has appointed as general manager of the Association General R. C. Marshall, Jr., recently chief of the Construction Division of the U. S. Army.

The Bulletin, the official publication of the Assocition says:

"The selection of General Marshall marks the beginning of the active campaign to carry through the program which has been developing during the past year of preliminary work. Besides the direction of the work of the sixteen committees, this program includes the development of the Publication and Information Service, the Contractors' Service Corporation, the Legislative Service, and other Service Bureaus of the Association, and the several Members' Divisions, including the Building Contractors' Division, the Public Works Contractors Division, the Highway Contractors' Division and the Railroad Contractors' Division—many of which have been organized in charge of different members of the staff during the past year.

The rapid growth of the association from a membership of 97 construction firms representing a few centers to 700 construction firms representing 36 states and 150 cities throughout the country, and the position of leadership which the association has been asked to take on questions of national importance relating to legislation, construction development, labor materials,, transportation, methods, trade practices, etc., as a result of the work which has already been done, offer to General Marshall a field of activity commensurate with the ability which he has shown as Chief of the Construction Division of the Army."

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Pure vs. Purified Water

No drink, pre-war or other, can compare with spring water fresh and cold from granite hills, or even from other geological formations. Would that such water could be furnished to the residents of every city! But even though there were enough of it to make this possible, after it had flowed through miles of pipes and conduits it would have lost some of its almost perfect purity, and in addition a certain quality which can not be detected by chemist or bacteriologist but is as real as the difference between the ozone-laden air of the balsam forest where it emerged from the rocks and the dead air of the city where it is drawn from the faucet.

In the northern part of New Jersey there is a population of about two million on an area of about one thousand square miles, or two thousand to the square mile. The yield or run-off of this section is about 400,000 gallons per day per square mile, or sufficient to supply 100 gallons per capita daily to four thousand people if all of it were retained in intercepting reservoirs. In other words, half of the water flowing from the entire area is needed to supply the present population; and in thirty to fifty years, when the population will have doubled, the run-off from the entire area will be needed. But part of this area is salt meadows, low land in river bottoms and other areas the yield of which can not be utilized unless as flow in the rivers. Probably not more than ten per cent of the area is such, topographically and geographically, that its yield can be impounded in reservoirs above the sources of actual sewage pollution, while very little of it is not subject to pollution from small settlements and farms.

It is therefore evident that not only spring water but even that from impounded mountain streams is unattainable by a great part of the population of this area. In fact, even at present it is necessary to use water from rivers, and thus avail of the run-off from low lands and of the headwaters of the rivers outside the area under consideration.

All of which is in explanation of the decision of the New Jersey Board, recorded elsewhere in this issue, that Montclair, already enjoying a purified water supply that is safe and better than many cities are content with, can not expect to obtain a part of the limited mountain stream supplies of the state which has already been acquired by another municipality. Water that is naturally pure (in the popular use of that term, which means safe and palatable) can be had by comparatively few, in the northern states at least; the majority must be content if they receive purified water which is almost if not quite equally safe, if not so acceptable to the palate and imagination.

General Marshall Manager A. G- C.

The appointment of Gen. R. C. Marshall, Jr., as manager of the Associated General Contractors of America, is of great importance in that it gives definite leadership and provides a responsible and experienced head to worthily represent a powerful organization.

The association, General Marshall, and the public are to be congratulated on the coordination of unusual ability and very wide and successful experience, intimate relations with great construction problems and the high prestige that Gen. Marshall possesses, with the enormous growing influence of the association, its large membership of great contractors, its already great influence in national, state and private construction matters and its avowed program for developments and federation of active interests embracing hundred of millions of dollars of property and thousands of individual engineers, owners and contractors annually.

After many years of preparatory work by various organizations in its endeavor to create a national association of construction interests, the Associated General Contractors of America, organized less than 2 years ago, immediately assumed a high position commanding respect for its personnel and its technical and financial standing, and has rapidly developed to a point where it is the accepted national leader, and maintains important offices at the Capitol and in great cities and numerous branches throughout the country, with classified special departments dealing with many of the greatest and most difficult problems of construction interests.

The appointment of an abundantly qualified executive who can coordinate all of the interests and give his entire personal attention to their direction, is the one step most needed to promote the greatest security and most rapid development of the association.

Gen. Marshall brings to this position a unique experience covering 20 years service in the U. S. Army in charge of a vast amount of public work of a wide variety including almost all kinds of ordinary and difficult construction.

Since he was made chief of the construction division of the army on June 26, 1918, he has had charge of all building work for the War Department involving an expenditure of nearly $1,000,000,000, much of it for emergency work under conditions of unprecedented haste and difficulty. The rapid and efficient execution of this work has brought Gen. Marshall into contact with a great number of officials, contractors, and all kinds of people interested in the work, as well as with federal, financial and commercial bodies with whom tactful diplomacy and full knowledge of the work were indispensable.

The experience and high reputation due to his great success, and his attractive and forceful personality, together with his popularity and the wide extent of his personal acquaintance, will be invaluable to the Associated General Contractors.

Every engineer, contractor, public official, architect and dealer who is directly or indircely interested in construction work will benefit with the Associated General Contractors in the notable success that we take great pleasure in predicting for Gen. Marshall and the Association.

Car Priority Unjust to Construction

The recent order of the Interstate Commerce Commission requiring railroads to give preference to coal mines east of the Mississippi river in the assignment of open cars, has caused so much injury and danger to various construction interests that the representatives of many important industries have petitioned the commission to revoke or modify the order, or their businesses will be closed, many employees thrown out of work, and important construction operations crippled and stopped.

The dealers and manufacturers of crushed stone, cement, sand gravel and lime and general building supplies and building contractors are among those protesting. The representative of the National Crushed Stone Association stated that road contractors are facing bankruptcy through the operation of this order, and various other industries complain that if continued, it will put them out of business. The representatives of the Federal Bureau of Highway Construcion and of several state highway commissions urge that 2,000 cars be made availabile daily for moving roadbuilding materials required for maintenance and for the completion of old contracts.

New Water Supply Works of Winnipeg*

By **JAMES H. FUERTES**

Continues the discussion of the conditions and principles upon which were based the capacities of the several parts of the aqueduct and appurtenances.

Population Growth and Water Consumption Requirements—As a basis for the plan for distributing the water to the different municipalities, therefore, the quantities of water required by each, and the rates at which it may be needed, now or in the future, are of vital importance.

The necessity of considering fire drafts in the estimates arises from the fact that, although the city now has high pressure fire service, in future the fire pumping engines will be supplied with water from the new aqueduct,, and the aqueduct system will respond to the demands as occurring, the same as though the water were to be pumped from the McPhillips street reservoir.

The estimates were intended for the purpose only, of forming a basis for the proportioning of the sizes and capacities of the future water supply works the district will have to provide. They may, in individual districts, prove to be more or less inaccurate; but for the purposes intended exactness is not essential, as very considerable variations from the true conditions will but slightly affect the total, and will have only a negligible effect on the actual dimensions of the works. They are to be regarded more as aids in fixing upon the ultimate limits than as representing actually the absolute variations to be expected from year to year.

Effect of Rate of Draft on Capacities of Pipe Line, Force Mains and Pumps—The rate of use of water by a community varies from hour to hour and from day to day; and the actual demands in the Winnipeg District may amount to two and a half to three times the average daily rate of consumption. To allow for such fluctuations, either the aqueduct must deliver the water as fast as required at any moment, and its actual effective capacity be only from 40 to 33 per cent of its full capacity, or a storage reservoir must be provided near town to supply the water required by sudden heavy drafts.

Deacon Reservoir a Necessity Soon—Where long aqueducts are in service, it is more practicable to build large storage reservoirs than to build the aqueduct large enough to accommodate the maximum possible draft for short times, the purpose of these large reservoirs being to allow a full and large supply in response to sudden heavy drafts without necessitating sudden changes in velocity in the pipe line, and to store excess water, not needed during hours of light draft, for use later during heavy drafts.

In an aqueduct conveying water by gravity flow under limited and comparatively low heads, it is not practicable to quickly speed up or check down the velocity of the water in the conduit, as it would be in a closed force main; hence a considerable amount of storage is necessary to permit satisfactory operating conditions.

The difference in rate between average rates of draft and maximum rates is so great, and high rates may prevail so long, that while a day's supply of water in storage is sufficient to balance extremes of draft when the supply can come to the reservoir at a rate equal to the daily maximum rate of draft, it would take several weeks of storage capacity, if the water entered the reservoir at the average daily rate of draft, to afford the same balancing effect. For this reason it is quite usual, where the supply can come to the reservoir at the maximum daily rate of draft, to provide at least one day's storage for carrying the peak drafts.

As above stated, the original plans provided for a reservoir of 250,000,000 gallons capacity to be built at Deacon, in line with the above policy. The original plans, however, provided for discharging the water from Deacon to Winnipeg by gravity up to a limit of 25,000,000 gallons per day, and pumping the water from Deacon to Winnipeg when the consumption shall have exceeded 25,000,000 gallons per day.

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*Continued from page 40

For this purpose it was provided that the force main from Deacon to Winnipeg should be a 5 foot riveted steel pipe as far as Red river, then a 5 foot cast-iron lined tunnel under Red river, and then a 4-foot cast-iron pipe from Red River to the McPhillips street reservoir. The pumping station at Deacon was intended to pump the water at sufficient pressure to supply the district through the existing street mains in the different municipalities.

Effect of Delivery "in bulk" on Designs—A reading of the Act, however, discloses that there was no warrant for the delivery of the water other than "in bulk," and this led to a change in the plans whereby the water would be delivered, in the future, to the different municipalities at ground level, to be repumped by each municipality in accordance with its own needs. This change will limit the variation in rate of delivery from Deacon to the district between the minimum rate and maximum *daily* rate instead of the minimum rate and maximum *hourly* rate, which latter would be the case if the pumping were done at Deacon.

The Deacon reservoir will, therefore, be used for the same purposes as in the original plan, but may be of smaller capacity than originally intended, owing to the fact that part of the original capacity provided, namely, that part required to balance the hourly variations in pump drafts, must be provided nearer the Red river.

For some years there will be no urgent necessity for the large reservoir. Cleaning of the aqueduct will not be needed for several years, and it will be many years hence before the aqueduct between Deacon and Shoal lake will be called on to deliver water up to its maximum discharging capacity, even at maximum rates of consumption in the district; nevertheless, with but one aqueduct nearly 100 miles long, it would be prudent to get the reservoir built at an early date.

Taking into account the changes in operating conditions due to the adoption of the plan of delivering the water to the district at ground level instead of pumping it into the mains, the capacity of the Deacon reservoir can be reduced to 200 million gallons, provisions being made for supplemental storage in the future at a point not far from Red river, sufficient to take care of fluctuations in the hourly rate of pumping, when required, or about 60,000,000 gallons, as will be described later on.

Supply Conditions between Deacon and Red River—The plan adopted was to provide at the end of the 8-foot circular aqueduct at Deacon for a connection to the Deacon reservoir, when built, by means of a bye-pass direct to the 5-foot 6-inch concrete pipe from Deacon to Red river, connections being also provided so that water may later be taken into the 5-foot 6-inch concrete pipe from either half of the proposed reservoir. All the water, whether going to the reservoir and thence to the 5-foot 6-inch pipe line leading to the Red river, or being bye-passed directly to the 5-foot 6-inch line, will pass through a Venturi meter built into the line.

At the east bank of the Red river the 5-foot 6-inch concrete pipe ends in a surge tank having a 18-inch cast-iron connection to the shaft at the west end of the tunnel under Red river and also a 12 inch cast-iron connection for the suction pipes of booster pumps to be used later when necessary, to force the water to McPhillips street in the quantities required. An overflow from the surge tank discharging through a 36-inch cast-iron pipe to the river will give relief so that the pressures in the 5 foot 6 inch concrete pipe will not exceed certain predetermined amounts when the water may surge therein, due to the starting or stopping of the booster pumps.

There is no valve between the surge tank and the aqueduct, so that by no accident of operation can this connection be closed. The connection between the surge tank and the tunnel under Red river, however, is provided with a valve in the west shaft of the tunnel to enable the surge tank to be cut off; and a valved connection to the tunnel will permit the water taken by the booster pumps from the surge tank to be forced through the tunnel and thence to McPhillips street, when more water is needed there than will flow there by gravity through the aqueduct from Deacon.

Having thus outlined, in a general way, the conditions to be fulfilled—that is, to deliver to the McPhillips street reservoir as much water as practicable by gravity and then boost over from Red river surge tank as much as required, bearing in mind the requirements of each of the municipalities forming the district, the problem became one of fixing upon the proper sizes for the pipe lines and tunnel, the capacities of the booster pumps and the dimensions and details of the surge tank, and to fix upon a plan for the distribution of the water to the different municipalities, in bulk, in proportion to their needs, present and future, and to have the works when built such that they could economically be adapted to whatever final plan of future development the district might adopt.

Supply for Winnipeg and its Dependents—The city of Winnipeg proper, which, before the introduction of Shoal lake water, supplied Assiniboia, Kildonan and Fort Garry, has at McPhillips street a 25,000,000-gallon covered reservoir, together with a pumping station used for pumping the water from this reservoir into the city street mains direct.

There are no high level distribution reservoirs or stand-pipes in the system, so that the pumps must respond to all changes of pressure corresponding to a varying rate of draft. This reservoir is large enough to serve until the population shall have grown enough to require an average of about 25,000,000 gallons of water daily, corresponding, for local conditions, to a maximum daily rate of 35,000,000 gallons.

This quantity, therefore (35,000,000 gallons daily), would represent the capacity required in the pipe line from Red river to McPhillips street to utilize the reservoir to its full practicable capacity. With this condition, the maximum actual rate of pumping of water out of McPhillips street reservoir might be as great as 60,000,000 gallons daily for an hour or two, the extra quantity of water for these short periods being furnished from the storage in the reservoir.

As will be explained later, however, the pipe line from Red river to McPhillips street reservoir must be able to deliver water at the rate of 50,000,000 gallons per day, as that is the rated capacity chosen for the booster pump. The McPhillips street pumping station and reservoir are located in the city of Winnipeg and occupy all the land available for the purpose, so that any increase in reservoir capacity beyond that now available must, on account of the value of land thereabouts, be had elsewhere.

The pumps at McPhillips street could be increased in number and capacity, and a pumping capacity in excess of 25,000,000 gallons daily could be maintained there by putting the booster pumps at Red river in use to boost over the extra quantity, beyond that which will flow over by gravity, required for peak loads. Careful studies of this question, however, showed that it would be preferable to definitely limit the capacity of the McPhillips street station to an average 25,000,000 gallons daily, and establish another pumping center on the east side of Red river for furnishing the extra water in future through new force mains, when more than 25,000,000 gallons daily should be required in the district now served by the McPhillips street plant.

This plan is simple and has many advantages, among which the greatest is that, without sacrificing any of the work to be done under it at the present time, it could be changed at any time to fit in with any of the other practicable schemes of development. The dimensions of the works as built, therefore, are determined in accordance with this plan, which involves the least expenditure for the district, both for construction and for operation.

PROGRAM FOR DEVELOPMENT

The practical effect of these assumptions on the design of the works is seen from the accompanying diagram which shows the hydraulic gradient under various conditions of draft.

At the right hand side of the diagram at station 900 is shown the western end of the last gravity flow aqueduct section, which is 8 feet 9 inches wide and 7 feet 4¾ inches high, with its invert at elevation 792.0. The top of the arch would therefore be at elevation 799.40. In order not to have any upward pressure on this arched section, the elevation of the hydraulic grade was fixed at 797.5 for the maximum rates of draft at the different critical dates.

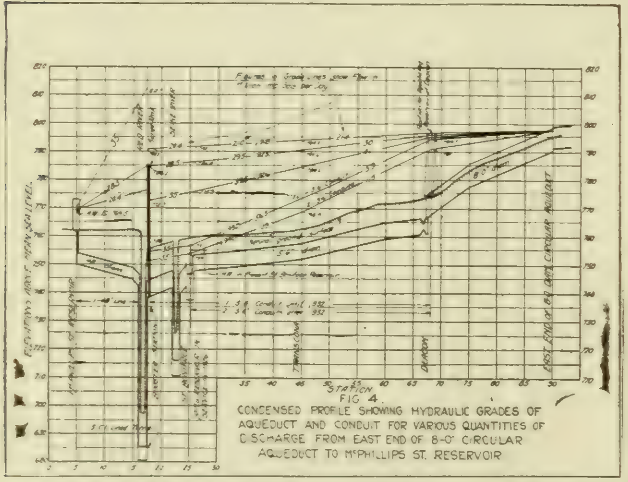


FIG 4.
CONDENSED PROFILE SHOWING HYDRAULIC GRADES OF AQUEDUCT AND CONDUIT FOR VARIOUS QUANTITIES OF DISCHARGE FROM EAST END OF 8-0" CIRCULAR AQUEDUCT TO McPHILLIPS ST. RESERVOIR

HYDRAULIC GRADES OF AQUEDUCTS STUDIED

A number of studies of different sizes of pipes, with the resulting grades for discharging the water, showed that for the materials to be used a 4-foot 6-inch reinforced concrete pipe from Deacon to Red river, and a 48-inch reinforced concrete pipe from Red river to McPhillips street reservoir, would be most economical for immediate construction and would take care of the consumption until about 1932.

This program would require, after that date, the laying of another 5-foot 6-inch conduit from Deacon to St. Boniface, with provisions at that place for pumping the extra water directly into the street mains of the municipalities both sides of Red river. At St. Boniface will be required a storage reservoir or pump-well holding about 10,000,000 gallons at the start, to be increased to about 60,000,000 gallons capacity eventually, but by degrees, to equalize the flow through the aqueduct during times of excessive pumping rates; and for proper service, the smaller capacity of storage and the requisite pumps and the connection from the first 5-foot 6-inch conduit should be ready by about 1926.

This part of the ultimate plant, however, and the large reservoir at Deacon are not yet a necessity, and have not been built or provided for, except as to connections with the 5-foot 6-inch conduit, which are all in place and ready when needed. At the St. Boniface pumping station the water will be pumped to street main pressure and the cost of the station and the operation be borne by the municipalities benefited rather than by the district, which has fulfilled its obligation by bringing the water, in bulk, to all its component municipalities.

It will be observed from the diagram that the quantity of water to be delivered to the McPhillips street reservoir is limited to an average of 25 million gallons daily (35 m. g. d. max. rate) and that quantities up to 28,500,000 gallons daily can be delivered into that reservoir by gravity. This latter figure would correspond to an average daily consumption of a little over 20 million gallons. The hydraulic grades shown in each case are for the maximum daily rates of consumption.

It will be observed, also, that the head on the 5-foot 6-inch pipe may vary from 12 to about 47 feet, the greatest head being for the delivery of about 20 million gallons per day to McPhillips street by gravity, and the least for the maximum consumption and pumpage at St. Boniface, years hence. After about 1926 the conditions of discharge to McPhillips street will remain practically the same as to routine operation; that is, an average of 25 m. g. d. will be sent to McPhillips street, part of it by gravity and the remainder by booster pumping.

The lift in the booster pumps in 1926 will be about 40 feet; this will increase gradually to a maximum of 61.5 feet by 1942, when two 5-foot 6-inch conduits will be in use and the total average consumption in the district about 100,000,000 gallons daily (nearly 50 per cent in excess of the average daily consumption that can be taken care of by the present gravity flow aqueduct between Deacon and Shoal lake).

(To be continued)

Recent Legal Decisions

CONSIDERATION FOR MUNICIPAL CONTRACTOR'S INDEMNITY BOND

The Indiana Appellate Court, United States F. & G. Co. v. Schauer Co., 126 N. E. 860, holds that an agreement by the surety on the bond of a municipal contractor, on assignment of the contract, to continue on the bond, was a sufficient consideration for the execution of an indemnifying bond; the consideration being a continuing one, and there being clearly an assumption of a new risk.

SUFFICIENCY OF NOTICE OF SUBCONTRACTOR'S DEFAULT

The Circuit Court of Appeals, Fifth Circuit, holds, United States F. G. Co. v. Sutherlin Const. Co., 263 Fed. 360, that notice by a principal contractor to a subcontractor that he was in default, necessary to render his surety liable, does not require to state the time within which he must resume work, where the time is fixed by the contract, or where he is given a reasonable time.

LABOR PERFORMED OR FURNISHED AND MATERIAL USED IN PUBLIC WORKS—MEANING OF "WORK"

The mere use of an appliance, however necessary or useful to the prosecution of a public building or other construction or repair of a public work, such as a staging and falls, is not labor performed or furnished or material used in such construction or repair within the reasonable intendment of Massachusetts Rev. Laws, c. 6, § 77, providing that officers or agents who contract for the commonwealth for such work shall obtain security for payment by the contractor and subcontractors for labor performed and furnished and for materials used; nor is a claim for a premium on an insurance liability policy issued to the contractor for a public work within the statute.

Within the provisions of the statute requiring a claimant for labor or material against the surety of a contractor for a public work to file a sworn statement of his claim with the officers or agents of the commonwealth within 60 days after completion of the work, the Massachusetts Supreme Court holds, Bay State Dredging etc. Co. v. W. H. Ellis & Son Co., 126 N. E. 468, that the word "work" means the public work embraced within the terms of the contract as it existed when the contractor or subcontractor was required to furnish sufficient security for the labor and material to be performed or furnished; and the right to have the benefit of that security enured to any laborer and materialman who should furnish labor or material which was used or employed in the construction or repair of the public work if he should file a sworn statement of his claim within 60 days after the completion of the work contemplated by the original contract, even of it be not completed by the original contractor.

FAILURE TO PAY INSTALLMENT JUSTIFYING REFUSAL TO COMPLETE

Where a contract provides that labor is to be performed and materials furnished over a considerable period of time, involving large expenditures by the contractor, and where payments, based on the amount of the work previously done, are likewise spread over a long period of time as the work progresses, the covenant of the contractor to preform the work is dependent upon the covenant of the other party to pay therefor as the work progressed and at the times specified in the contract, unless the contract provides that such covenants are to be independent of each other, or that the time provided for the payment of installments is not a material stipulation; and failure to pay an installment when due will justify the contractor in refusing to complete the work. United States Fidelity, etc., Co., v. Robert Grace Contracting Co., 263 Fed. 285.

CONTRACTORS' OPTION TO SELECT METHOD OF DOING WORK

The New York Appellate Division holds, Charles Meads & Co. v. New York, 191 App. Div. 365, 181 N. Y. Supp. 704, that where a crack in the foundation walls of a public library resulted from a defect in the plans which the contractor was required to follow in his work, he is entitled to recover, notwithstanding the refusal of the architect and the borough president to give the required certificate; for under those circumstances it was their duty to give it and their refusal so to do was unreasonable. Following the doctrine that where the architect, representing the owner, requires the contractor to do the work on a plausible, but erroneous, interpretation of the contract, and the contractor protests, he may submit, do the work and have his action against the owner for the expense, on the theory of a breach of the contract, the court holds that where the architect claimed the right to deprive the contractor of the option given him to protect an excavation by pitching the banks and sheathing from two feet above the base of the bank to the bottom of the excavation, and required him to install instead an elaborate system of truss work, the contractor was entitled to the additional cost of the sheathing, shoring and trussing on the theory that it was a breach of the contract to require it. So long as a contractor produces work which satisfies the specifications, he can, in the interest of economy, choose his own methods. This is not only law, but common sense; for when a contractor bids, his estimates, which influence the bid, were necessarily based on his own methods of work, so long as those methods are not controlled by the specifications.

SEPARATE ACTIONS AGAINST DEFAULTING CONTRACTOR ENJOINED

The federal district court of the Eastern District of Missouri holds, Barston v. Mingo Drainage Dist., 264 Fed. 224, that the jurisdiction of equity on the ground of preventing a multiplicity of suits cannot be invoked in support of a suit by a defaulting contractor to do work for a drainage district who had given bond and also a contract to indemnify his surety, to enjoin the district, the surety, and creditors to whom he was indebteded for labor and materials from bringing action on any claims they might severally have against him and to require them to submit such claims in that suit.

Subgrade Investigation by Bureau of Public Roads

To study effect of increasing thickness of pavement in distributing load, increasing inertia and strength, and to improve drainage.

The division of tests of the Bureau of Public Roads is making investigations in the vicinity of Washington to obtain accurate scientific information regarding the characteristics of soils which affect their bearing value.

The problem of avoiding road failures of the kind which can be traced to poor foundations seems to be possible of solution in one of the following ways:

1. Make the road surface thick enough to distribute pressure over an area of subgrade sufficiently wide to reduce the intensity of pressure to a degree capable of support by the subgrade.
2. By increasing the thickness of the road surface add to its inertia sufficiently to absorb a considerable amount of the shock of traffic.
3. Design road slabs to have sufficient strength to bridge over the soft subgrade.
4. Improve drainage so as to exclude moisture in dangerous amounts from soils, the bearing value of which is seriously affected by the presence of moisture.

It is perhaps true that all soils have adequate bearing value when the amount of water in them is kept within certain low limits; or, it may be possible that certain soils can be treated in some way which will improve their natural bearing value.

It is obvious that if knowledge of road construction is to be advanced, first attention must be given to the road foundation, and accurate information must be obtained as to the properties of soils which make them good or poor soils for foundation purposes.

The investigations which have been begun in the vicinity of Washington are designed to yield information of this character; and it is now planned to extend the scope of the investigation by obtaining the cooperation of the various State highway departments.

A memorandum has been sent to each of the 13 district engineers of the bureau, describing the character of the information it is desired to obtain. Each of the engineers is asked to secure the cooperation of the State highway departments and State geologists in obtaining samples of soil from subgrades underlying sections of road which have failed apparently because of poor drainage or peculiar soil condition.

The samples are to be 1 cubic foot in volume, and each is to be taken from the subgrade, preferably directly under the failure. Accompanying the sample the engineers are asked to supply photographs of the site of the failure and complete information in regard to the topography of the vicinity, the character of the failure, the approximate amount of traffic, drainage conditions, the presence of water-bearing strata, or other conditions which might contribute to the failure of the subgrade. Particular emphasis is placed upon the necessity of showing how the water reached the subgrade, whether by vertical capillarity, horizontal capillarity, through seepage strata, or from the surface.

It is suggested that a 1½-inch auger will be useful for exploring the underlying soil, and that much useful information may be obtained by noting the texture and moisture content of the soil at different depths. Thus, if the soil at the surface is wet, and below it is very compact, dense, and dry, it may be assumed as probable that the water has entered the subgrade from the surface, and has been prevented from escaping by the underlying impervious layer. If, on the other hand, the underlying layer of a wet subgrade is wet and porous, and it in turn is underlain by a compact, impervious layer the former is a seepage stratum through which the water flows and rises to the upper layers of the subgrade by vertical capillarity. A number of combinations are to be expected, and each must be carefully studied to determine how the water which exists in the subgrade at the time of failure arrived there.

It is believed that observations of a large number of failures together with samples of the soil underlying them, and similar observations and samples pertaining to sections of the same roads which have not failed, will furnish a clue as to the causes of such failures and lead eventually to the discovery of proper remedies.

The investigation is now in its preliminary stages, and the data which are asked for at this time are designed only to serve as the ground work for a very far-reaching investigation which will follow, in which it is hoped to enlist the cooperation of State university laboratories, organizations of engineers, and individuals throughout the country.

New York's Refuse Disposal

The committee on Health and Sanitation of the Chamber of Commerce of Brooklyn, New York, headed by Dr. Williams S. Hubbard, has recently prepared to report in which it urges the city officials to adopt immediately a comprehensive policy for dealing with the waste materials of the city. At the present time garbage is loaded in the scows and towed twenty miles beyond Scotland Light Ship, where it is dumped into the sea. A committee estimates that this method of disposal costs about $3 per ton, which is more than is necessary for many methods of sanitary disposal.

In disposing of its ashes, the city pays the Brooklyn Ash Removal Company $1.32½ per cart load to carry away ashes which the city delivers to the company and loads into its carts, the ashes being used by the company to fill in lands which it owns at Flushing, although the city owns a large area of land at Dyker Beach, much of which is under water and could be filled in with much profit to the community.

The contract for this ash removal will end on March 31, 1921, that for the removal of dead animals can be cancelled on June 30, 1921, the last garbage contract has already been voided, and the ash and rubbish contracts for Manhattan and the Bronx have been abandoned. This, therefore, would seem to be an opportune time for the city to change its method to more sanitary and economical ones. At present it is spending approximately $10,000,000 a year for collecting and disposal of waste, from which it receives no returns, either direct or indirect. The committee declares that not only could the present cost be greatly reduced, but the grease and fertilizer contained in the garbage, if properly extracted, would bring in an annual income of approximately $3,000,000, and the saleable material and rubbish, if sorted and disposed of, would yield an additional profit of $200,000 to $250,000 a year; while the ashes could be used for filling in low land owned by the city and thus greatly increase the value of such property.

Lansing Increases Light and Water Rates

The Department of Water and Light of Lansing, Michigan, has announced that there will be an increase of 40 per cent in all electric light and power rates and an increase of 35 per cent in all water rates, beginning with July 15th. This will give the rate for water as 12 cents for the first 2,000 cubic feet, 11 cents for the next 3,000 cubic feet, down to 6 cents for all over 500,000. There is a service charge against meters varying from 65 cents for the ⅝ inch meter up to $30 for the 8-inch meter. The total charge is a combination of this service charge and the water rate. The rates for light will be 8½ cents per k. w. h. for the first 50 k. w. h., decreasing to 3½ cents for all over 4,000 with $1 as a minimum charge. All bills are payable quarterly.

Wayne County's Road Program Abridged

Wayne County, Michigan, began the year with an ambitious road construction program and made a record start at the beginning of the year, but the work has been thrown into confusion by the switchmen's strike and the inadequacy of transportation facilities, and it now seems doubtful whether as much as 15 miles of pavement will be laid this year.

In addition to the road work, it is necessary for the county to spend about $1,500,000 for new bridges, in addition to that already appropriated for two bridges over the River Rouge. Most of the bridges in the county should be rebuilt to accommodate heavier loads.

Decatur's New Dam

For several years Decatur has been threatened each summer with a water shortage, but this summer the danger is greater than ever because the city's consumption has increased about 3,000,000 gallons a day, or approximately 50%, because of increased population and especially of increased amounts required by local industries. In order to avert any future dangers of shortage, the city is about to begin the construction of a new dam and it was expected early in July that actual work would begin before the end of that month. The work is in charge of Pearse & Greeley, as consulting engineers, and will be in direct charge of Mr. Hawkins as resident engineer.

No labor shortage is anticipated, the contractors finding the labor situation to be improved over what it was some months ago. They propose, however, to use as many labor saving devices as possible in order to expedite the work and minimize labor turnover.

Combination of Water Companies Advised

The city of Elizabeth, N. J., through the Board of Pubic Utility Commission, has ordered that the Elizabethtown Water Company, the Plainfield Union Water Company and the Middlesex Water Company make improvements so as to increase the supply of water. It further has recommended that the three companies consolidate in order to eliminate conflicts of interest and assist in the development of a proper financial plan under which the service needed can be supplied.

Apportioning New Jersey Water

The New Jersey Public Utility Commission has ordered the Elizabethtown Water Company and the Plainfield-Union Water Company to install meters on their services in order to conserve the water supply, and has instructed the Middlesex Water Company to install booster pumping equipment with a capacity of 4,000,000 gallons a day. The Middlesex Company is helping out the shortage in Elizabeth, 5,000,000 gallons a day being delivered to that city by the company, which has resulted in a shortage of supply in some of the other communities which receive their supplies from the Middlesex Company. It has been suggested that Perth Amboy can furnish 10,000,000 gallons a day to these companies and thus solve, temporarily at least, the shortage problem which confronts them, since the municipal supply of Perth Amboy can furnish 20,000,000 gallons a day, while the consumption by the city is only 10,000,000 gallons.

Increased Pay for Subway Engineers

A little more than 6 months ago, the lower-salaried engineers employed by the Transit Construction Commission of New York City received an increase of $300 a year, which has been repeated by action of the commission taken June 25.

Laborers Returning to Europe

From Cleveland there is reported a very active movement of Poles, Jugo-Slavs, and Hungarians back to their homes in Europe; inward movement of immigrants is improving, but these are mostly unskilled, while a large percentage of those leaving are at least semi-skilled.

NEWS OF THE SOCIETIES

July 26-30 — INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS. Annual convention, Toronto, Canada. Secretary, Stephen E. Hoey, Municipal Bldg., New York.

August 14-18 — ENGINEERING INSTITUTE OF CANADA, CALGARY, BRANCH. Meeting at Banff. F. C. Emery, secretary, western professional meeting, Calgary, Canada.

Aug. 26-Sept. 3—AMERICAN PUBLIC HEALTH ASSOCIATION. San Francisco. Office of secretary.

Sept. 7-16 — NEW ENGLAND WATER WORKS AASSOCIATION. Annual convention, Holyoke, Mass. Secretary, Frank J. Gifford, 715 Tremont Temple, Boston, Mass.

Sept. 13-17—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual convention, San Francisco, Cal.

Sept. 13-17 — SOUTHWESTERN WATER WORKS ASSOCIATION. Annual convention, St. Charles Hotel, New Orleans, La. Secretary, E. L. Fulkerson, Waco, Texas.

Oct. 12-14—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention, St. Louis, Mo. Secretary, Charles Carroll Brown, 401 Lincoln Avenue, Valparaiso, Ill.

CANADIAN SECTION OF AMERICAN WATER WORKS ASSOCIATION

A Canadian section of the American Water Works Association having about 100 members has been formed and has elected Alexander Milne, chairman; F. H. Pitcher, vice-chairman; and H. G. Hunter, secretary. branch of the parent society.

THE SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION

The 28th annual meeting of the society of the promotion of engineering education was held at the University of Michigan, Ann Arbor, June 29-July 2nd, and important papers on "Cooperation Between Industry and Education," by R. D. Chapin and S. P. Capen and on "The Pay of Engineering Educators," by Dr. F. H. Newell were presented and thoroughly discussed. It was held that there is necessity for better training in the fundamentals and for specialization in industrial directions.

Cooperation between universities and great corporations was illustrated by a description of the 5-year electrical course given in connection with the General Electric Company at Lynn, Mass. No action was taken on the question of increased salary for engineering instructors. It was decided to hold the next meeting at Yale University, June 28-29 and 30, 1921 and there were elected, Pres., M. E. Cooley, Vice-Presidents T. U. Taylor, and H. S. Stevens, Secretary, F. L. Bishop and Treasurer, W. O. Wiley.

NEW YORK POST SOCIETY OF AMERICAN MILITARY ENGINEERS

One hundred engineers formerly in military service met June 15th in Room 512, Army Building, 39 Whitehall Street, New York, and unanimously voted to form a New York branch of the parent society.

Temporary officers were appointed and a committee to draw up a scheme of organization and nominations for permanent officers.

On June 29, about 100 former officers and enlisted men organized the New York Post of the American Society of Military Engineers, adopted a constitution, arranged for applications for a charter from the parent organization and elected as president, Col. F. A. Molitor, Vice-Pres., Col. G. D. Synder; Secretary, Major P. E. Barbour; Assistant Secretary, Sargeant Allen Fitzgerald, and Treasurer, Major R. C. Coiner. Col. R. B. Black, Major E. F. Robinson, Lieut. Col. A. S. Dwight and Col. Dunn were elected as directors at large.

MINNESOTA FEDERATION OF ENGINEERS AND ARCHITECTS

On June 19, there was held in Duluth a meeting of about 200 engineers and architects representing five local engineering organizations and the state chapters of all the national engineering and architectural societies, and resolutions were adopted for the formation of a federation of engineers and architects whose membership may embrace all engineers and architects in the state. It includes the federation into one body of Minnesota Surveyors and Engineers Society, the Engineers Club at Minneapolis, the Engineers Society of St. Paul, The Duluth Engineers Club, Minnesota Chapter of American Institute of Architects, the Engineers Club of Northern Minnesota, and others. The State Federation is divided into sections representing architecture and the various branches of engineering for technical discussions in these respective branches at the annual convention.

It was decided that the State Federation should assume the publication of the bulletin, maintain an office, employ a secretary, editor and assistants, and that the expenses be paid by a per capita tax.

NATIONAL RESEARCH COUNCIL COMMITTEE

The engineering division of the National Research Council, Dr. C. Adams, chairman, has appointed twenty different committees on special subjects to work on problems of immediate importance to industry. Three committees on subjects of special interest to civil engineers are, "Committee on Economic Theory of Highway Improvement"—T. R. Agg, chairman, professor of highway engineering, Iowa State College, Ames, Iowa; C. A. Baughman, R. B. H. Begg, L. E. Conrad, H. S. Fairbank, D. C. Fenner, R. B. Gage, H. J. Hughes, Mark L. Ireland, A. N. Johnson, H. J. Kuelling, H. J. MacIntire and R. W. Schoredor; "Committtee on Structural Design of Roads"—A. M. Goldbeck, chairman, engineer of tests, Bureau of Public Roads, Washington, D. C.; "Committee on Tests and Properties of Road Materials"—H. S. Mattimore, chairman, engineer of tests, Pennsylvania State Hwy. Department, Harrisburg, Pa.; R. W. Crum, H. J. Hughes, F. C. Lang, Morton Owen Withy.

AMERICAN ASSOCIATION OF ENGINEERS

At the June 30th meeting of the Indianapolis Chapter of the American Association of Engineers, a report was received stating that the county surveyor is underpaid, that he is financing the road surveys without compensation and with the prospect of loss, and that he has charge of county engineering when qualified but no authority for the employment of specially trained deputies for special work.

The reports of the ethics committee and of the legislative committee were received and subjects for discussion at the next meeting were announced to be a consideration of hypothetical cases of the ethical features of the practice of engineers to submit through contractors alternate plans for which the designs have already been made by the county engineer who is paid for his services whether these designs or alternative ones are accepted.

ENGINEERING INSTITUTE OF CANADA

The Calgary Branch of the Engineering Institute of Canada will hold a tent meeting, under canvas, on the banks of the Bow river near the Banff Springs Hotel, Banff, Canada, Aug. 14-18. The Canadian Government will furnish tents, cots, mattresses and blankets, but visitors are requested to bring bed linen and towels. It will be possible to make reservations at the hotel if preferred, provided applications are received not later than July 25. All engineers are cordially invited to communicate with the secretary, Western Professional Meeting, care of Gorman, Clancy and Grindley,

AMERICAN SOCIETY OF CIVIL ENGINEERS

The Colorado section of the American Society of Civil Engineers held its annual meeting June 12, and elected, as president, Oliver T. Reedy; vice-president, A. M. Miller and secretary-treasurer, John S. Meads.

THE SOUTH CAROLINA GOOD ROADS INSTITUTE

The roadbuilders of South Carolina, under the auspices of the three state colleges and the state highway department, have recently organized the South Carolina Good Roads Institute and have elected a secretary whose address is in care of the State Highway Department, Columbia, South Carolina. It will be the secretary's duty to keep the members of the institute informed as to the current prices of cement, pipe culverts, structural and reinforcing steel, stones and construction work.

TECHNICAL CLUB OF DALLAS, TEXAS

The technical club of Dallas has unanimously voted an application for membership in the Federated American Engineering Societies.

OHIO STATE ENGINEERS

The Ohio state engineers society at the Columbus convention elected as president, John H. Matse; vice-pres., W. L. Shawkey; secretary, Geo. P. Kalsgye; and as treasurer, T. S. Garret.

New Appliances

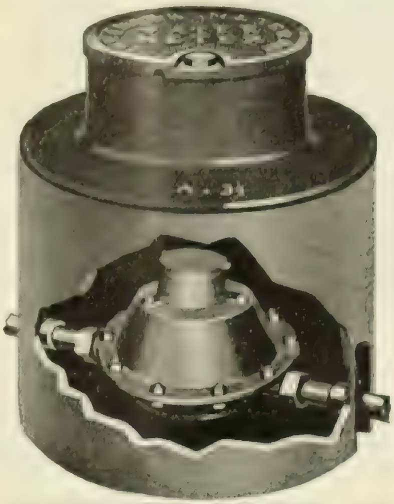
Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

SOUTHERN METER BOXES

The "Southern" meter boxes, made by the H. W. Clark Company, are designed to protect the delicate mechanism of a water meter and to be securely covered and locked without forming an obstruction or jeopardizing the safety and convenience of pedestrians. Their use enables the meter to be removed from the interior of buildings and placed where it should be, at the curb. They are manufactured on a large scale, on lines resulting from the practical experience of engineers constructing and operating waterworks, and are made in many models to suit the requirements of southern waterworks. They are described and illustrated in Bulletin A, which gives complete directions for the installation of the different types of the box.

The box consists of a vitrified, concrete, or cast-iron cone or cylinder large enough to receive the meter or the meter and valve, with slots in the lower edges for the entrance and exit of the service pipe. The cast-iron box is covered by a cast-iron top and lid, the latter being simply and effectively locked in position. Similar covers and lids are provided for brick or concrete boxes suitable for large size meters.

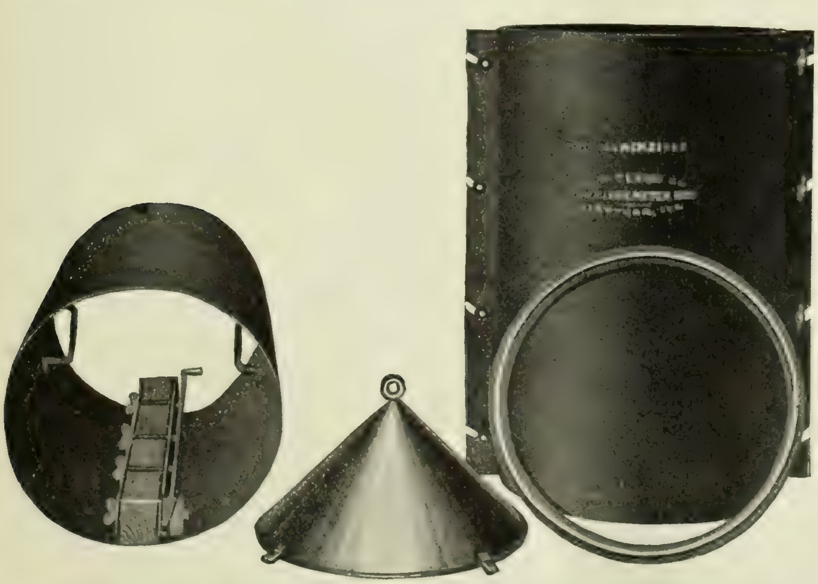
Collapsible steel forms are provided for the more rapid and economical construction of concrete boxes, either clyindrical or conical. The conical box permits the use of a smaller top and lid than is required for the cylindrical box. The same company furnishes meter box coupling yokes designed to give great rigidity to meter supply pipes and to eliminate strains and leaks while providing for expansion and contraction. The same results are secured by the use of the basement coupling yokes that can be used when the meter is installed inside the building.



VITRIFIED METER BOX WITH CAST IRON TOP AND LID.

The Teksagon meter coupling is also provided by the same company to secure meter connections without the use of a gasket, thus avoiding leaks and choked waterways without involving any extra expense.

The Clark Company also sends, on application, bulletins descriptive of testing instruments, service boxes, pumps, water meters, fire hydrants and valves, and municipal and miscellaneous castings.



FORMS FOR CONICAL AND CYLINDRI CAL CONCRETE METER BOXES

THE SMITH GASOLINE PAVER

The 1920 Smith Paver, gasoline equipped, is claimed to be the first machine in the field to feature a four cylinder, automobile truck type, heavy-duty motor. It is a Wisconsin motor, same as is used on many high-grade trucks, and operates at the slow speed of 722 r. p. m.

The 10 E paver is equipped with a 25-h. p. motor, the 14 E with 30-h. p., and the 21 E with 36-h. p., about three times the power of the steam engine on the same models. This surplus of power is necessary because a gasoline engine does not have the flexibility that a steam engine does, and therefore the amount of power necessary must be determined by the peak load. If anything short of this is supplied the danger of the motor going dead on a big pull is ever present.

Keeping the engine cool is another point that has been taken care of in an unusual manner on this paver. A radiator three times the size of that used on the ordinary motor truck, and holding 6 gallons of water, is used.

The motor is equipped with Eiseman magneto, fitted with impulse starter, and a Stromberg carburator, fitted with a Wilcox-Bennet air cleaner. The engine is cranked by a regular auto-type crank.

The positive noiseless and efficient drive is novel. The pinion on the engine shaft is a rawhide pinion. Both of the larger driving gears are machine-cut from semi-steel blanks.

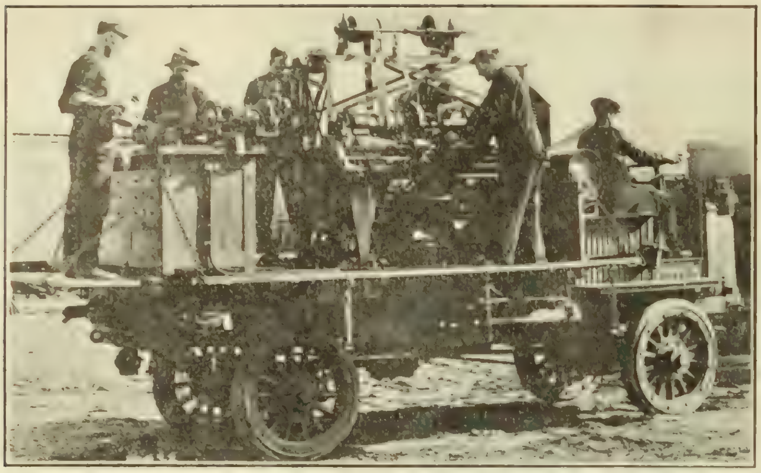
A PERAMBULATING TRUCK REPAIR SHOP

Mounted on automobile trucks, complete machine shops fitted for the repairs of automobile trucks were, during the war, furnished in considerable quqantities by the Four-Wheel Drive Auto Co., for the the U. S. Government at home and abroad.

Their use was found to be so advantageous where a large fleet of trucks were employed, that the company is now putting them on the market for the use of roadbuilders, general contractors and other large concerns that operate numerous automobiles and trucks. They have proved to be a sensible and satisfactory medium for maintaining the equipment in constant running order with a minimum loss of time, thus promoting a continuous operation of every truck in the fleet.

Mounted on the chassis is complete equipment to handle any kind of repair job. A separate motor furnished the power for operating the various machine tools. This embraces such mechanical apparatus as a drill press, screw cutting lathe, electric grinder, blow torch, welding outfit, forge and more than 100 other pieces of machinery and tools.

Each tool and piece of machinery has its own location, insuring compactness when the end and side panels are up and the truck is in motion. The fact that a great number of these moving repair shops were furnished the government by the Four-Wheel Drive Auto Company during the war is proof of their value in caring for fleets of trucks. With the increasing



MACHINE TOOL EQUIPMENT INSTALLED ON TRUCK

tendency to operate fleets of trucks in various industries, the efficiency of the machine shop truck will soon make it an important factor with every fleet owner.

INDUSTRIAL NOTES

DWIGHT P. ROBINSON & CO., INC.

The consolidation is announced of Westinghouse, Church, Kerr & Co., Inc., and Dwight P. Robinson & Co., Inc., under the name of Dwight P. Robinson and Company, Incorporated, Engineers and Contractors, General Offices, 25 East 46th Street. Downtown Office, 62 Broadway, New York, Chicago, Cleveland, Pittsburgh, Dallas.

The officers are: Dwight P. Robinson, President; T. N. Gilmore, First Vice-President; J. W. McConnell, Vice-President; A. K. Wood, Vice-President and Treasurer; R. M. Henderson, Vice-President; L. H. Bean, Vice-President; H. H. Kerr, Vice-President, Chicago Office; W. L. Murray, Secretary.

The directors are: Paul D. Cravath, Cravath and Henderson, Attorneys; Thomas N. Gilmore, First Vice-President; Homer Loring, Loring and Company, Boston; Ira W. McConnell, Vice-President; John P. McGinley, Chairman, Chicago Pneumatic Tool Company; Harry T. Peters, President, The Fairbanks Company; Dwight P. Robinson, President; Edward R. Tinker, Vice-President, Chase National Bank; Arthur King Wood, Vice-President and Treasurer.

NATIONAL LIME ASSOCIATION

The second annual convention of the National Lime Association was held in New York City, June 17-18. Several technical and commercial papers and addresses were presented and the officers of the association were reelected, Chas. Warner, Pres., Geo. J. Nicholson, Vice-Pres., and A. A. Lauman, Treasurer.

COMPRESSED AIR FOR THE ROAD BUILDER

Under this title, the Ingersoll-Rand Company has issued an attractively illustrated 24-page pamphlet containing valuable practical data on road-building in rocky country with lists of the plant used and results obtained and specific contracts and special information regarding the machine dressing of drill bits.

It also discusses different methods of quarrying and the plant required for it, and some of the features of trench excavation for pipe laying together with the application of compressed air to operate pneumatic tools and a convenient portable hoist. The use of pneumatic tools for cutting through concrete pavements and for taking out test pieces is described and various types of air compressors and pneumatic tools suitable for the road builder are illustrated and briefly described with reference to commercial bulletins in which they are fully detailed.

PERSONALS

Martin, J. A., commissioner of Department of Purchases and Supplies of Detroit, has been appointed Commissioner of Public Works.

Wooley, J. C., has been appointed professor of agricultural engineering at the University of Missouri.

Whitehead, J. B., has been made dean of the department of engineering of the John Hopkins University.

Chenoweth & Rettinghouse, have opened consulting engineering offices, at 215 Boyce-Greeley Bldg., Sioux Falls, S. D.

Campbell, R. T., has been appointed chief engineer of Brainerd, Minn.

Nettleton, E. S. has been appointed acting city engineer of New Haven, Ct.

Sala, P. L., has been appointed building inspector of Stockton, Calif.

Parsons, W. B., consulting engineer, New York, has received from the Princeton University, the degree of doctor of science.

Gault, Matthew, superintendent of sewers at Worcester, Mass., died died June 26.

Hughes, Prof. Hector James, has been appointed dean of the engineering school at Harvard University with which institution he has been connected since his appointment there as instructor in civil engineering in 1903.

Howell, D. J., has been appointed chief engineer of the Arlington Sanitary District, Alexandria County, Virginia.

Merrill, O. C., chief engineer, U. S. Forest Service has been appointed chairman of the Federal Power Commission.

Wasser, P. J., county engineer of Hudson County, has been appointed state highway engineer of New Jersey to succeed Wm. G. Thompson, resigned.

Doebler, S. Frank, has been put in charge of construction work on the Austin dam across the Colorado river, which will immediately be resumed after having been suspended for 4 years.

Witt, J. F., has been made vice-president of the South-Central Division of the National Highway Traffic Association.

Green, R. M., professor highway engineering at the Agricultural and Mechanical College of Texas has resigned that position to accept the presidency of the Western Laboratories at Lincoln, Neb. and will specialize in testing and inspecting all kinds of building materials and operations.

Smith, J. W., has been appointed irrigation engineer for the Montana Irrigation Commission.

Bowen, P. M., has been appointed engineer of District No. 5, New Mexico State Highway Department.

Fithdan, J. H., has been appointed supervisor of the New Jersey State Highway System through Comberland County, and parts of Salem and Gloucester Counties.

Strong, S. D., city engineer of Sault St. Marie, Michigan has resigned that position to become city manager of Plymouth, Mich.

Dartt, Harvey, has resigned the position of city manager of Mankato, Minn.

Mahon, A U., state engineer ot Montana has resigned that position to join the Western Construction Company, Helena, Mont.

Hidel, C. S., the former assistant, has been appointed state engineer of Montana.

Thompson, James, city engineer of Dundee, Scotland has been elected president of the Institution of Municipal and County Engineers of Great Britain.

Wilkinson, Thomas L., has opened an office as consulting engineer at Denver, Colorado.

McMillan, Major H. L., formerly employed by the Bureau of Surveys, Philadelphia, has been appointed to the engineering staff of the Sanitary District of Chicago.

McClintock, N. J., and George R. Newell, have opened engineering offices in Rochester, N. Y.

Loder, A. E., has been appointed district engineer of the U. S. Bureau of Public Roads incharge of South Carolina, Georgia, Florida, Alabama, Mississippi and Tennessee with headquarters at Washington, D. C.

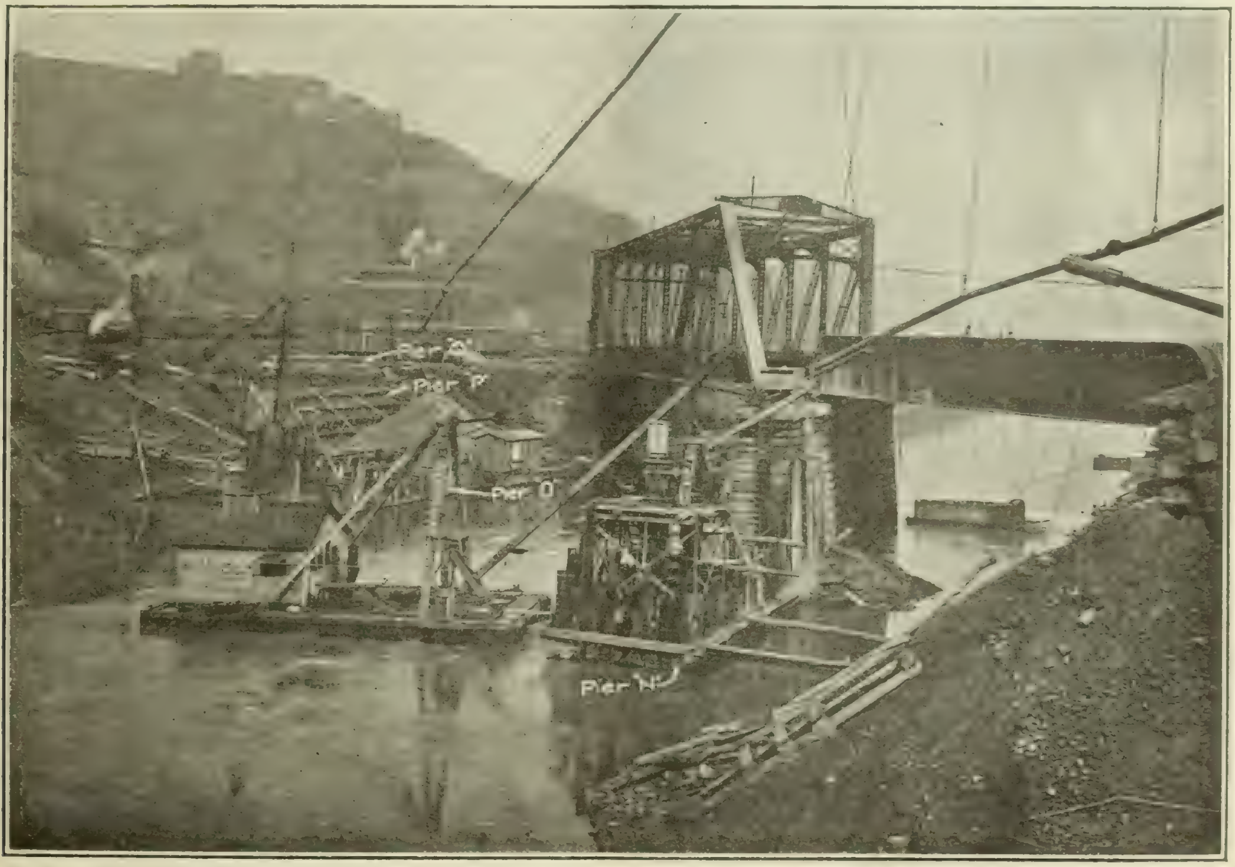
Lee, W. T., of the topographic branch, U. S. Geological Survey has been detailed to make aeroplane studies of North and South Carolina and Maryland.

PUBLIC WORKS.
CITY COUNTY STATE
A Combination of "MUNICIPAL JOURNAL AND PUBLIC WORKS" and "CONTRACTING"
Vol. 49 FLORAL PARK, JULY 24, 1920 No. 4

Allegheny River Bridge Piers

Twenty piers and abutments for the Baltimore & Ohio railroad bridge across the Allegheny river and Herr's island, Pittsburgh, built with a variety of methods, including pneumatic caissons, cast-in-place concrete piles, open sheet-pile cofferdam and air bell. One pier supported on ancient submerged pile foundation was unexpectedly disclosed by the excavation.

At Pittsburgh a double-track line of the Baltimore & Ohio railroad crosses the main and back channels of the Allegheny river, and Herr's island that separates them, on a bridge with a tangent alignment across the main channel and a curved alignment across the island and back channel. In the reconstruction of the bridge a number of the piers under the tangent and adjacent to it were built on the old alignment, but clear of the superstructure and intermediate between the old piers. At a point on Herr's island, the old alignment diverges from the new one, the latter being carried, at the end of the bridge, on a pile trestle. The new piers under the curved alignment across the back channel of the river and on both sides of it, are parallel with the axis of the river and considerably skewed with the



SINKING RIVER PIER FOUNDATIONS BY PNEUMATIC CAISSON PROCESS bridge alignment. Several of them join the old piers end to end.

PLANT AND EQUIPMENT

The main part of the contractor's plant was installed on Herr's island, where there were erected a boiler house and air compressor shed, a concrete mixing plant with a steel hoisting tower 225 feet high, four stiffleg derricks commanding some of the piers and serving the concrete mixing plant, a contractor's siding approximately parallel to the bridge alignment, and a detour track temporarily, carrying the railroad traffic clear of the new piers that were located partly on the old and partly on the new alignment.

The contractor also installed several stiffleg derricks on both banks of the river, installed a concrete spouting cable parallel to the alignment between the west end of the bridge and the hoisting tower, and at the east end of the bridge established a caisson building yard and launching ways for the construction of the wooden pneumatic caissons.

CAISSON FOUNDATION

At the east end of the bridge, three 70x72-foot caissons were sunk to a depth of about 60 feet to bearing on the bed rock. These caissons being located directly under the old spans, were somewhat cramped for headroom for the air locks and were served by floating derricks that handled the muck and the concrete.

BUILDING, LAUNCHING, AND FLOATING WOODEN PNEUMATIC CAISSON

Two other piers, those on the banks of the island, were built with wooden pneumatic caisson foundations but in these cases the caissons, instead of being constructed at the contractor's yard on the east bank of the river and floated to position, were built in *situ* and concreted with the same plant that was used for the main channel piers. Air pressure was put on the first of the five pneumatic caissons Sept. 18, 1919, and the last working chamber was concreted December 21st.

OLD PILE FOUNDATIONS UTILIZED

The pneumatic caisson pier on the east bank of Herr's island was intended to be sunk to rock about 48 feet below water level, but at a depth of 13 feet there was encountered a course of stone 28 inches thick on a timber grillage 28 inches thick supported by wooden piles 3 feet apart on centers. Although these piles had been driven about 40 years, they were found to be sound and in good condition. Excavation was carried down about 5 feet below their tops, and they were cut off and supported the concrete filling of the working chamber at a depth of about 22 feet below water level.

The west abutment and the six piers next to it were built on Simplex piles. The seven piers on Herr's island were built on foundation of Simplex concrete piles extending to above water level.

Two of the piers on the west side of Herr's island and the adjacent pier in the back channel were built in steel sheet-pile cofferdams. In one of these piers the foundation was made with Simplex concrete piles and in another it was mass concrete laid in an open excavation carried down to a depth of about 22 feet below water level.

In the third of these cofferdam piers (pier N. in the back channel, which was built adjacent to the end of the old pier), it was found impossible to unwater the cofferdam by ordinary methods, and a shallow airtight wooden caisson built of planks and fitted with airshafts and airlocks was installed in the cofferdam and concentric with it. This caisson, called an air bell, was sunk to bearing on the bottom of the river and the space between it and the cofferdam was sealed with concrete deposited by a tremie. After this concrete had set, the cofferdam was pumped out and concrete was built up to water level permanently enclosing the air bell, which thus formed a working chamber under the center of the pier.

After the light air bell had been throughly protected and strengthened by the mass of concrete above it, air pressure was put on, the water expelled, and men entered the bell, cleaned and benched the rock, and filled the bell, or working chamber with concrete, thus carrying the pier foundation down to solid rock about 20 feet below low-water level.

The work was done under the direction of the engineering department of the Baltimore & Ohio Railroad by the Vang Construction Company, Cumberland, Maryland. It was commenced in July, 1919, and has been completed as far as pos-

PLACING AIR WELL INSIDE FLOODED COFFERDAM

sible before the erection of the steel superstructure. After that is finished, the old river pier at the east end will be removed and replaced by a new one and the tops of the five new piers under the old structure will be finished and the old piers removed.

Special Rail Handling Method

Steel rails for the main lines of the Union Pacific Railroad in Nebraska were shipped in cattle cars during the winter of 1919-20, because of the impossibility of securing open top cars. The rails were unloaded through holes cut in the ends of the cars and were handled by special tongs or hooks engaging the bolt holes in the ends of the rail and attached to a hoist line operated by an American railroad ditcher machine mounted on a flat car that was separated from the rail car by an idler flat car. After a quantity of the rails had been removed from the stock car and placed on the floor of the idler car, the special hooks were replaced by regular rail tongs, and the rails unloaded from the flat car and put in position along the track in the usual manner manner. By this method an average of six carloads or about 450 rails were unloaded daily by one 10-man gang working between trains under difficult conditions of heavy main line traffic.

Asphalt Paving in Tarboro

By W. A. Hardenbergh

Labor saving appliances in asphalt pavement construction. The steam shovel is used as a wagon booster. Thickness of base adapted to traffic anticipated. Aggregate raised to mixer by bucket elevator, both electrically driven.

Located in the center of a very rich cotton, tobacco, and peanut section, the city of Tarboro, N. C., is one of those fortunate municipalities which finds itself able to initiate and carry out an extensive program of municipal improvements. In addition to a very complete local health organization, sewers are being extended and a paving program involving the laying of 80,000 square yards of asphalt pavement is under way. Of the paving work, about 50 per cent is now completed and the contractor, F. J. McGuire, of Norfolk, Va., is pushing the work rapidly.

There is some difficulty in securing an adequate supply of labor, but this is not a pressing problem. To as great an extent as possible, mechanical equipment is used. With mechanical equipment, good men are necessary. These are secured at rates of $3.50 to 4.50 per day. Most of these men are truck drivers, or semi-skilled in other ways.

Practically all the paving is of 2-course asphalt on a concrete base, with concrete curb and gutter cast in one piece. The only variation in the paving program, which covers the city pretty completely, is a specification requiring a thicker concrete base on those streets where it is expected traffic will ultimately become very heavy in wheel-load as well as volume.

About 500 yards of pavement are being placed daily by the contractor. Machinery and motor trucks are used whenever possible. Hauls are nearly all short, as the town is a compact area of five or six thousand population, but motor truck hauling has proved economical nevertheless. Throughout, the work shows careful planning and administration.

Considerable grading has been necessary, but this has practically all been very shallow. In fact, the bulk of it has not exceeded 8 inches in depth, the proposition being chiefly one of lowering the old street level enough to permit the construction of a concrete base and asphalt top. To handle this work, the contractor has used with considerable success two No. 6 Keystone shovels. The excavation is rather easy, as a rule, as the soil is mainly a sandy loam with practically no stones or hardpan to interfere.

Federal 2½-ton trucks have been used exclusively in the hauling and transportation, handling the spoil from the excavation, concrete aggregate, the concrete itself, and, finally, the hot asphalt.

By means of locating nearby places to dump or fill, hauls of spoil have been kept very short, and three trucks will more than handle the excavation of one shovel. The hauls rarely exceed a quarter of a mile.

Some of the streets were wide enough so that but half the street width could be excavated at one time. In this case, the trucks usually backed alongside the shovel on the old pavement for filling, and so were favored with a good roadway. On narrower streets, and when excavating the final half of wide streets, it was found advisable to back the trucks, in a majority of cases, onto the subgrade, and just to one side of the shovel for easy filling. With the solid tires and the soft sub-grade, there was trouble at once, as the trucks usually sank down to the running gear, which resulted in delay, owing to the inability of the truck to pull out under its own power. This was remedied by "boosting" the truck out with the shovel. This method was completely successful and the shovel operator soon became very expert at it. But it was found that the pressure sprung the back door of the steel body. The superintendent, Mr. Johnston, then designed a "booster brace" of 4x4 timber, reinforced across the tail gate of the trucks. This device, which is shown in the illustrations, prevented any damage to the truck, and made the booster plan one of real value.

SHOWING BOOSTER BAR ON REAR OF TRUCK

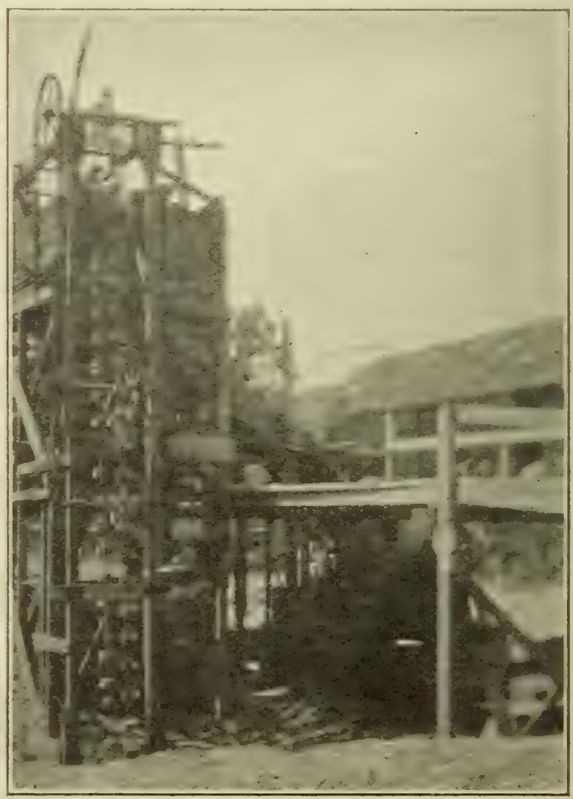
KEYSTONE SHOVEL LOADING TRUCK

The power of the shovel when boosting was impressive. On several occasions when the driver had killed his engine by too quick an application of the clutch, the shovel pushed the loaded truck, the dirt of the subgrade scraping the running gear, clear out over the loose dirt which piles up ahead of the shovel, and onto the firm pavement, actually recranking the truck engine in the process. The shovel man soon became so expert at this that scarcely a moment was wasted.

Three men, only, were employed at the shovels—an operator, a fireman and helper combined, and a man to handle the rope for dumping the bucket.

THE MIXING PLANT

One man was on each truck. Every truck was equipped with mechanical dumping apparatus. One man was at the dump to direct the placing of the earth. With this equipment and personnel, the work proceeded very well.



ELEVATORS AT THE MIXING PLANT

Fine grading was done by horses and scoops or scrapers and by hand, the method and the number of men depending upon the work to be done, the particular street and the number of men available.

The pavement base was 1: 2: 4 concrete, 4 inches thick on most of the streets. On those streets where it seemed that the future might bring traffic of heavy wheel load, as those leading to the freight stations and along the railroad tracks, a 6-inch base was laid, using the same mix.

All concrete mixing was done at a central plant, and the wet concrete hauled in tight steel-body trucks to the streets, where it was spread as desired. A T. L. Smith mixer was mounted on a platform of such height that the mixer would dump readily into a truck beneath. Sand and stone were stored in overhead bins, and cement was brought from the cement shed over a runway. The entire outfit was operated electrically. Giant portland cement was used.

Stone and sand had to be shipped in by rail, and the cars were unloaded near the mixer. If the cars were equipped with dump bottoms, they were run onto a small trestle and dumped. Otherwise they were unloaded by men with shovels, the piles being as near as convenient to the mixer.

The sand and stone were raised to the overhead bins by means of Jeffery elevators, also electrically driven. The transfer of the aggregate from the piles where it had been unloaded, to the elevator buckets was not, as is usual, by means of a wheelbarrow gang. Two mules, each hitched to a slip scraper, did this at a considerable saving.

A stock pile of stone was stored on a vacant lot. When needed, a Keystone shovel loaded this direct into trucks, by which it was carried to the point of demand. This reserve was located at a central point for the paving work, and for the construction of a concrete culvert by the same firm.

As stated before, the mixer as well as the elevators is electrically driven. This is a considerable saving in cost, both from the power and the labor standpoint. With the arrangement described, of overhead bins for stone and sand, a nearby cement shed and electric drive, efficiency and economy were secured with a minimum of lost time and with few men.

The mixed concrete was dumped into the motor trucks and hauled at once to the street. As most of the hauls were very short and the mixture was kept rather dry, there was no trouble from separation of the aggregates, nor was it difficult to clean the bottom of the truck-body. This method of handling the concrete was very satisfactory and required only about half as many men as the usual method of mixing on the spot.

The asphalt pavement is laid in two courses, each an inch and a half thick. The binder course is being mixed with 10 1-3 per cent of asphaltic cement (Texaco), 54 to 56 pounds of filler and 500 pounds of stone. The wearing course contains approximately the same percentages, substituting sand for the stone.

A Cummer 800-yard plant is being used for making the mix. At times this plant has been operated to or beyond its full capacity, but at present the daily average is in the neighborhood of 500 square yards.

The same type of Federal 2½ ton truck, of which there are eight or ten on the job, is used for hauling the "hot stuff." The asphalt mixture is loaded direct into the truck in the usual fashion and hauled to the street. The average gang on laying is comprised of one rollerman, one finisher, three shovelers, and three rakers. A Kelly-Springfield roller is used for rolling the asphalt.

Throughout, the job shows evidence of good management and a careful use of machinery instead of men, whenever possible. No costs have been given on the work, nor are prices available at present.

Road Work in Illinois

On July 2nd, superintendent S. E. Bradt, of the Illinois Division of Highways, reported 57 road gangs at work completing 15 miles of hard road each week, and that he still has hope of completing the season's program of 450 miles of Federal Aid road, there being a prospect of raising the weekly total to 25 miles. However, the shortage of cars is threatening the program seriously.

Road Maintenance in Maine

Both patrol and gang method used. The method of giving a bituminous surface to gravel roads is described.

The following is from the report for the year 1919 of the State Highway Commission of Maine:

Maintenance work was continued as it has been carried on for the last three years, principally by the patrol method. In another part of this report will be found a detailed summary of that work. It will be noticed that the prevailing high costs of labor and material are reflected in the costs of this work as compared with similar costs in 1918.

Besides the patrol maintenance considerable work was done by gangs. This work is principally on improved state highways. We have a considerable mileage of gravel surfaced state highway which carries excessive motor vehicle traffic, official counts showing as high as 5,500 motor vehicles passing a given point in twelve hours time, from seven o'clock in the morning until seven in the evening, this count being a daily average for one week. A plain gravel surface would not last a week under this kind of travel, so it has become necessary to give these sections a bituminous surface treatment in order to preserve them. A good many inquiries have been received about our method of surface treating gravel roads, so a brief summary of the operation will be given here.

Surface treatment can only be successfully applied to a clean, well bonded surface having a true cross section. The first step is the distribution of clean, coarse and sharp sand along the shoulder of the road in piles about thirty feet apart, using about forty to fifty cubic yards per mile. This sand is used to cover the bituminous material after it has been spread upon the road.

The next step is to thoroughly clean the surface with a horse sweeper and hand brooms, in this way removing all dust and loose material. The bituminous material is then spread from a pressure distributor tank mounted either on an automobile truck chassis or drawn by horses. The amount of bituminous material per square yard of surface depends on the condition of the surface and as a general thing good results will not be obtained by making a uniform distribution over the whole area, because it is very rare that any considerable area will present exactly uniform conditions. This means in practice that more or less material per square yard must be used according to the condition of the surface. In our practice the amount of bituminous material is controlled entirely by the judgment of the man in charge of the work. He rides on the truck and from his knowledge of the conditions determines the amount of pressure to be applied to the tank, the opening of the valves that control the flow of tar, and the speed of the truck. On new surfaces the rate of distribution will vary from four-tenths of a gallon to one-half a gallon per square yard. The second, third or fourth years, the application may be as light as one-quarter of a gallon per square yard and usually is from three-tenths to one-third of a gallon..

This work must be done on a warm day and on a dry surface. If traffic conditions would permit we would allow the bituminous material to penetrate the surface six hours before covering with sand, but we find it necessary to immediately cover with sand from the piles alongside the road to keep the bituminous material from stripping up under steel tire traffic. Furthermore, there is great liability of automobiles skidding on the fresh bituminous material, and this is another reason for immediately covering with sand. About one-half the sand is immediately applied and during the next three or four days a few men are left behind to sand spots which show an excess of bituminous material as they appear. This means going over the same length of road several times. It is very important that the smallest possible amount of bituminous materials be used that will preserve the surface.

Except where drainage and foundation conditions are absolutely perfect this bituminous surface treatment will break up the following spring. It is very necessary where the breaking up occurs that the surface be reshaped by using the road machine and the drag. The surface must be kept in shape until it is settled and bonded, when another application can be made following substantially the steps outlined above, but using less bituminous material.

After three or four successive annual applications certain portions of the surface will become wavy. It is then necessary to break the surface by the use of a pressure scarifier or spike-tooth harrow. It is sometimes necessary to plow short sections and for this the point of a road machine blade may be used. After this course has been broken up it must then be pulverized. This may be done with a spike-tooth harrow or a steam roller with the picks. It also pulverizes more or less under travel. The pulverizing process can be hastened by working the material from one side of the road to the other with a road machine, letting travel break it up as much as possible. It is usually necessary to use a road machine every day from the time the surface is broken until the road is bonded for treatment. The more this material is worked over the more completely it will pulverize and a better surface will be presented for subsequent treatment. Immediately prior to the next treatment the surface must be carefully shaped. It may be necessary at this time to add a little binding material, preferably clay, but care should be taken not to use an excess of clay. Our practice has indicated that a quantity of fine pulverized clay (pulverized by frost action) about equal to the amount of sand cover, forty to fifty yards per mile, has given excellent results in preparing an old surface for re-treatment. The re-treatment of this surface after being broken is exactly identical with the original treatment, beginning with the sweeping. During the spring of 1919 a considerable mileage of road was broken up and re-treated as above rescribed, with very excellent results.

Street Repairing in Waltham, Mass.

The *Waltham Municipal Bulletin,* issued monthly, is a little different from most municipal publications. It reads something like a newspaper reporter's description of a ball game but gives real information concerning municipal affairs that should interest the public—a combination that should get it read by the citizens, which is what such a publication should aim at. The following is a sample of manner of presenting the more substantial information:

"The Street Division of the Public Works Department is putting forth every ounce of energy and working from every possible angle on the streets of our city, trying to get them in passable shape.

"Waltham, like all other cities and towns, was forced to curb its street construction and maintenance during the time Bill took the notion to run the world and the result is our streets are completely shot.

"We feel that some of our good citizens are unreasonable enough to expect us to rebuild in two months that which has been neglected for four years. This, of course, is impossible, but we are sure if our citizens will co-operate and be patient, the end of the construction season will show a big change for the betterment of Waltham's streets.

"Besides carrying on all the necessary incidental work of the department, over 200,000 square yards of street have been patched and oiled during the last three weeks. Many streets have been resurfaced with material excavated from streets being constructed of bituminous macadam and will receive a coat of oil in the near future. A few days will see the completion of River street, one of the many streets to be constructed under the $100,000 bond issue. The construction of River street consisted of reshaping the old macadam base by excavating from 3 to 4 inches of the old material. After this base had been throughly rolled, 3 inches of new stone, 2 inches in size, was spread evenly on it, and after being rolled an application of Tarvia X at the rate of 1½ gallons to the square yard was applied. Chestnut stone was then spread over the surface, just enough being used to fill the voids, and the whole road again thoroughly rolled. The surface was then sealed with ¾ gallons of Bermudez asphalt to the square yard, covered with pea stone, rolled, and opened to traffic.

"The following table shows the cost of River street and what it would cost six years ago. It might be of some interest to know that the best bid received on the above type of road was $2.00 per square yard, a saving of 60c per yard; or, on the 25,000 yards advertised on Lexington and High streets, the city will save $15,000."

Table showing cost of 2,980 square yards of bituminous macadam pavement on River street:

Labor 389 hours at .48	$186.72
Labor 1652 hours at .52	859.04
Labor 359½ hours at .56	201.32
Labor 175 5-6 hours at .625	109.99
Labor 116 hours at .688	79.76
Labor 10 hours at .812	8.12
Misc. and Sat. half holidays	122.57
Teams 55½ days, 4.75	263.63
Teams 5½ days, 2.25	12.38
Trucks 15 days, $12	180
Trucks 1½ days, $20	30
Rollers 14½ days, $6	87
Stone	922
Tarvia 4,280 gals. at .14	599.20
Asphalt 2,000 gals. at .24	480.
Coal	77.24
Total	$4,219.07

Per square yard, $1.41.

What River Street would have cost under 1914 prices:

2,041 hours at .275	$516.28
359½ hours at .306	110.01
175 5-6 hours at .375	65.24
116 hrs. at .344	39.90
10 hours at 50	5.00
Saturday half holiday	61.00
Teams 74 days at 3.00	222.00
Teams 5½ days at $1.50	82.50
Roller 14½ days at 1.75	25.28
Stone	310.00
Tarvia 4,280 gals. at 8¾c	374.50
Asphalt 2,000 gals. at 12c	240.00
Coal	25.00
Total	$2,122.41

Per square yard, $.71.

Municipal Ownership of Electric Railways

The restoration of credit is the principal task of the electric railways, according to John H. Pardee, president of the American Electric Railway Association. Investors demand a fair return on money invested in traction securities.

In 1917 the electric railways carried 11,000,000,000 passengers, an average of 108 rides for every man, woman and child in the country. This number was 2,000,000,000 greater than in 1912, and 4,000,000,000 greater than 1907. While the population of the country has increased 32 per cent the passenger traffic of electric railways has increased 137 per cent.

An examination of the report of municipally owned electric railways, according to Mr. Pardee, shows that municipal ownership is not the solution. Two of eight roads reported on included in their financial statements no charge because of interest on funded or unfunded debt, only three reported taxes, and two had tax charges which were pittances compared with the tax bills of privately owned companies. In spite of these favorable missions, the eight lines show a deficit for the year of $111,000, out of total operating revenues of $1,682,000, while the ninth road, not included in the total, had a deficit of operating expenses.

Road Making in Edmunds County S. D.

By WARD L. McCAFFERTY*

How the county forces make good gravel roads, even on gumbo soil.

There is in Edmunds County, South Dakota, some low, flat land and some that is very rough, but most of it is gently rolling. The roads generally follow the section lines, with an occasional short one intermediate. There is a state and federal highway running east and west near the center of the county, and seven county highways running north and south. Sixteen miles of state and federal aid highway is now under construction.

In constructing a county road we start out with an outfit called our blade grader crew, consisting of one Twin City 60-90 tractor pulling a 12-foot blade grader and one 90-120 Holt tractor pulling a 14-foot blade grader. This crew is fitted out with a complete outfit consisting of cook car and tents for sleeping quarters. We work both ways from camp, as a rule three miles each way. After the blade has made a round, it is followed up with a planer which brings the dirt in from both sides of the road to the center with one operation. After this has passed down the road, another blade grader follows it so that it can come back and do the same work pulling in the dirt with one operation. About three rounds with a blade grader with the planer following will make a complete graded road on level ground.

After we have passed over a section of road in this manner, we follow up with a crew to make fills in such places as require more dirt to bring the low places above high water. At the same time such culverts as are required to take care of the water in spring and after heavy rains are placed in the grades or fills as we go along. This completes a road known as a dirt road.

After these have been traveled a short time they are in condition for graveling. We maintain all these graded roads with such machinery as small engines for power and we have drags of several different makes. The three-way drag is about the best of this equipment. This is a three-section drag, the two outside drags bringing the loose dirt in towards the center of the road and the center drag distributing it evenly over the center of the highway and filling up the ruts in the road, if any have been produced during the rains by heavy traffic. I will say in passing that just dirt roads are not all-season roads, but they are good in summer and fall and most winters. Gravel surfacing will be done as rapidly as our funds will permit. In South Dakota our Motor Vehicle Fund (that is, license money from automobiles collected by the county treasurer) is placed at our disposal and can be used for dragging and all other maintenanc work and for graveling roads, but for no other purpose; in other words, all equipment for this work must be provided from other funds.

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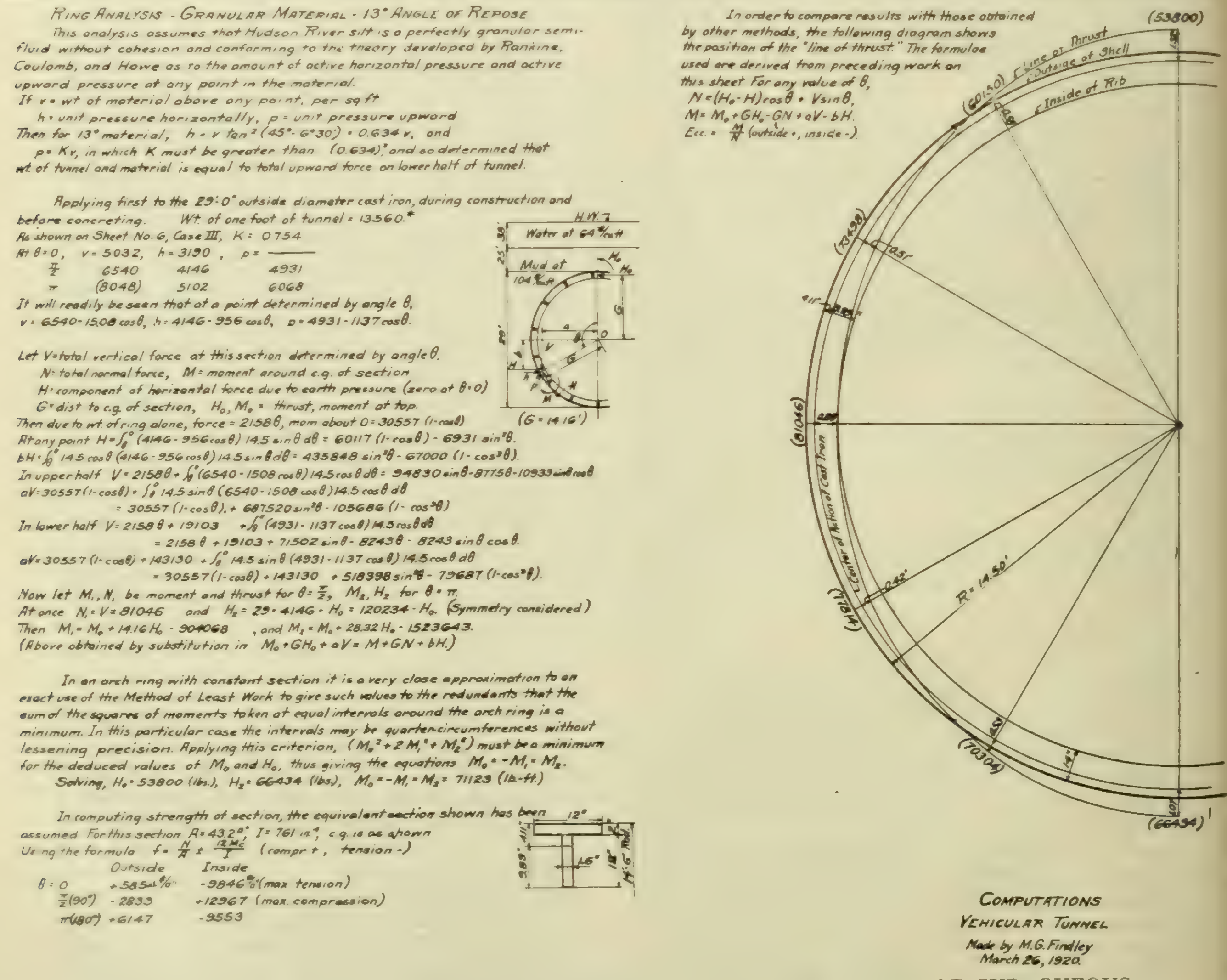
*Superintendent of highways of Edmunds County.

Our top soil is a deep, black loam, from 6 to 18 inches deep, under which is a clay subsoil. This subsoil, when worked into a road and covered with gravel, makes an ideal roadbed. In some parts of the county we have the gumbo soil. A great many held up their hands in horror when we started grading roads through the gumbo—they declared this would be our finish and that we could never make a road out of the gumbo soil, but experience has taught us that gumbo, if it is properly drained and maintained, is the best road soil we have and much better after being graveled than any other soil that we have here.

We hire and pay our crews by the hour—no work no pay. The cook car is furnished and as a rule is run by a man and wife, the husband working on the job and the wife doing the cooking, charging each one of the crew a certain price for their board, with no expense to the county, we simply furnishing the car and some minor equipment for the same.

We hire men and teams for dirt moving or making the fills by the yard. All our roads are surveyed and in this way we can easily follow the outfit making the fills and determine the exact amount of dirt moved and placed in the fills. We settle with them twice a month, holding back 15 per cent of the estimate until final settlement on the work for our protection.

We make a special effort and take great pride in keeping all our roads passable immediately following the crews and also while they are working. It is very seldom necessary to make detours on any roads that we are working.



RING ANALYSIS - GRANULAR MATERIAL - 13° ANGLE OF REPOSE

This analysis assumes that Hudson River silt is a perfectly granular semi-fluid without cohesion and conforming to the theory developed by Rankine, Coulomb, and Howe as to the amount of active horizontal pressure and active upward pressure at any point in the material.

If v = wt of material above any point, per sq ft
h = unit pressure horizontally, p = unit pressure upward
Then for 13° material, $h = v \tan^2(45° - 6°30') = 0.634\,v$, and
$p = Kv$, in which K must be greater than $(0.634)^2$ and so determined that wt. of tunnel and material is equal to total upward force on lower half of tunnel.

Applying first to the 29'-0" outside diameter cast iron, during construction and before concreting. Wt. of one foot of tunnel = 13560.*
As shown on Sheet No. 6, Case III, $K = 0.754$

	v	h	p
At $\theta = 0$,	5032	3190	——
$\frac{\pi}{2}$	6540	4146	4931
π	(8048)	5102	6068

It will readily be seen that at a point determined by angle θ,
$v = 6540 - 1508\cos\theta$, $h = 4146 - 956\cos\theta$, $p = 4931 - 1137\cos\theta$.

Let V = total vertical force at this section determined by angle θ,
N = total normal force, M = moment around c.g. of section
H = component of horizontal force due to earth pressure (zero at $\theta = 0$)
G = dist to c.g. of section, H_o, M_o = thrust, moment at top.
Then due to wt. of ring alone, force = 2158θ, mom about $O = 30557(1-\cos\theta)$
At any point $H = \int_\theta^0 (4146 - 956\cos\theta)\,14.5\sin\theta\,d\theta = 60117(1-\cos\theta) - 6931\sin^2\theta$.
$bH = \int_\theta^0 14.5\cos\theta\,(4146 - 956\cos\theta)\,14.5\sin\theta\,d\theta = 435848\sin^2\theta - 67000(1-\cos^3\theta)$.
In upper half $V = 2158\theta + \int_\theta^0 (6540 - 1508\cos\theta)\,14.5\cos\theta\,d\theta = 94830\sin\theta - 8775\theta - 10933\sin\theta\cos\theta$
$aV = 30557(1-\cos\theta) + \int_\theta^0 14.5\sin\theta\,(6540 - 1508\cos\theta)\,14.5\cos\theta\,d\theta$
$= 30557(1-\cos\theta) + 687520\sin^2\theta - 105686(1-\cos^3\theta)$
In lower half $V = 2158\theta + 19103 + \int_\theta^0 (4931 - 1137\cos\theta)\,14.5\cos\theta\,d\theta$
$= 2158\theta + 19103 + 71502\sin\theta - 8243\theta - 8243\sin\theta\cos\theta$.
$aV = 30557(1-\cos\theta) + 143130 + \int_\theta^0 14.5\sin\theta\,(4931 - 1137\cos\theta)\,14.5\cos\theta\,d\theta$
$= 30557(1-\cos\theta) + 143130 + 518398\sin^2\theta - 79687(1-\cos^3\theta)$.
Now let M_1, N_1 be moment and thrust for $\theta = \frac{\pi}{2}$, M_2, H_2 for $\theta = \pi$.
At once $N_1 = V = 81046$ and $H_2 = 29 \cdot 4146 - H_o = 120234 - H_o$. (Symmetry considered)
Then $M_1 = M_o + 14.16H_o - 904068$, and $M_2 = M_o + 28.32H_o - 1523643$.
(Above obtained by substitution in $M_o + GH_o + aV = M + GN + bH$.)

In an arch ring with constant section it is a very close approximation to an exact use of the Method of Least Work to give such values to the redundants that the sum of the squares of moments taken at equal intervals around the arch ring is a minimum. In this particular case the intervals may be quarter-circumferences without lessening precision. Applying this criterion, $(M_o^2 + 2M_1^2 + M_2^2)$ must be a minimum for the deduced values of M_o and H_o, thus giving the equations $M_o = -M_1 = M_2$.
Solving, $H_o = 53800$ (lbs.), $H_2 = 66434$ (lbs.), $M_o = -M_1 = M_2 = 71123$ (lb.-ft.)

In computing strength of section, the equivalent section shown has been assumed. For this section $A = 43.2\square''$, $I = 761$ in.^{4}, c.g. is as shown
Using the formula $f = \frac{N}{A} \pm \frac{12Mc}{I}$ (compr +, tension −)

	Outside	Inside
$\theta = 0$	+5854 #/□"	−9846 #/□" (max tension)
$\frac{\pi}{2}$(90°)	−2833	+12967 (max. compression)
π(180°)	+6147	−3553

In order to compare results with those obtained by other methods, the following diagram shows the position of the "line of thrust." The formulae used are derived from preceding work on this sheet. For any value of θ,
$N = (H_o - H)\cos\theta + V\sin\theta$,
$M = M_o + GH_o - GN + aV - bH$.
Ecc. = $\frac{M}{N}$ (outside +, inside −).

COMPUTATIONS
VEHICULAR TUNNEL
Made by M. G. Findley
March 26, 1920.

CALCULATION OF STRENGTH OF CYLINDRICAL CAST IRON SHELL OF SUBAQUEOUS TUNNEL 29 FEET DIAMETER

Mathematical Analyses of Concrete Block Tunnels

Ring analyses as applied to different types of tunnels proposed for vehicular crossing of the North River.

On page 549 of *Public Works* June 19 there was published an article entitled "Concrete Block Vehicular Tunnel Investigation." This article quoted at length from General Goethals' report to the Joint State Bridge and Tunnel Commissions dated April 2, 1920, on the theory of stress analysis of subaqueous tunnels and the structural strengths of cast iron and concrete block ring tunnels based on such theories.

The mathematical‡ analyses* accompanying the Generals' report included:

A. 29 foot outside diameter cast iron tunnel, based on Rankin's theory for granular material.
B. Derivation of general formular based on theory of analyses for pressure normal to tunnel.
C. Results of application of normal pressure theory to four cases, namely:
 1. 42 foot outside diameter concrete block tunnel;
 2. 36½ foot outside diameter concrete block tunnel;
 3. 29 foot outside diameter cast iron tunnel;
 4. 23 foot outside diameter Pennsylvania Railway tunnels under North River.
D. Computations for possibility of flotation of above types of tunnels, assuming perfectly granlar semi-fluid conditions with no cohesion.
E. Comparative longitudinal strengths of above tunnels.

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* These mathematical studies were made by M. G. Findley, assistant designing engineer.

‡ Note that the differential sign where used in the formulae is distinguished from small "d" by having the bottom of the vertical stem connected to the symbol immediately following.

Calculations Concerning Flotation and Longtitudinal Strength and Theory of Ring Analysis.

DATA AS TO POSSIBILITY OF FLOTATION.

This computation assumes that Hudson River silt is a perfectly granular semifluid without cohesion conforming to the theory developed by M A Howe as to the amount of active upward pressure at any point.

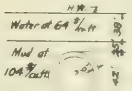
If v = wt of material above any given point, per sq ft

p = active upward pressure, in lbs. per sq. ft.

θ = angle of repose of material at given point

Then $p = Kv$, in which $K = \tan^4(45^\circ - \frac{1}{2}\theta)$

CASE I. Concrete block tunnel, 42'-0" outside diameter.



The forces acting downward and crossing the lower outside semicircumference, for 1'-0" length of tunnel, are

$42(38 \cdot 64 + 46 \cdot 104) - \frac{1}{2}\pi \cdot 21^2 \cdot 104 + \pi(21^2 - 18^2)150$
$= 286165.$

If mud were perfect fluid active upward pressure on this surface would be

$42(38 \cdot 64 + 46 \cdot 104) + \frac{1}{2}\pi \cdot 21^2 \cdot 104 = 375115.$

Thus structure will rise due unbalanced force if K is greater than

$\frac{286165}{375115} = 0.763.$ Corresponding angle of repose $\theta = 3^\circ 52'$.

CASE II. Concrete block, 36'-6" o d.

$36.5(38 \cdot 64 + 43.25 \cdot 104) - \frac{1}{2}\pi \cdot 18.25^2 \cdot 104 + \pi(18.25^2 - 15.25^2)150 = 245865$

$36.5(38 \cdot 64 + 43.25 \cdot 104) + \frac{1}{2}\pi \cdot 18.25^2 \cdot 104 = 307385.$

For critical angle of repose, $K' = \frac{245865}{307385} = 0.800.$ $\theta = 3^\circ 12'$.

CASE III. Cast iron, 29'-0" o d.

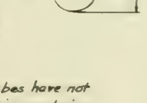
Wt of c i alone, before concrete is placed, is 13560# per lin ft.

$29(38 \cdot 64 + 39.5 \cdot 104) - \frac{1}{2}\pi \cdot 14.5^2 \cdot 104 + 13560 = 168874.$

$29(38 \cdot 64 + 39.5 \cdot 104) + \frac{1}{2}\pi \cdot 14.5^2 \cdot 104 = 224000$

For critical angle of repose, $K = \frac{168874}{224000} = 0.754.$ $\theta = 4^\circ 00'$

CASE IV. Pa tubes, cast iron, 23'-0" o. d.



Wt. of c.i alone is 9650# per lin. ft.

$23(60 \cdot 64 + 23.5 \cdot 104) - \frac{1}{2}\pi \cdot 11.5^2 \cdot 104 + 9650 = 132577$

$23(60 \cdot 64 + 23.5 \cdot 104) + \frac{1}{2}\pi \cdot 11.5^2 \cdot 104 = 166137.$

For critical angle of repose, $K = \frac{132577}{166137} = 0.798.$ $\theta = 3^\circ 14'$.

Summarizing the above results:

(a) The 29'-0" c.i. tunnel is most liable to rise.

(b) All four will rise in 3° material. As the Pa. tubes have not shown any tendency to rise, there is doubt as to cogency of this conclusion

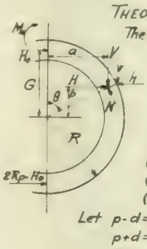
COMPARATIVE LONGITUDINAL STRENGTH.

Block tunnel 42'-0" o.d. - 160 bolts 1¾" diam - bolt circle ave. 39'-0" diam
Cast iron 29'-0" o.d. - 85 bolts 1¾" diam. - bolt circle approx. 28'-0" diam.
Pa tubes - 67 bolts 1½" diam. - bolt circle approx. 22'-0" diam.

From this information is obtained the following table of safe loadings:
(Forces in kips, moments in kip-feet.)

	Block 42'-0"	C.I. 29'-0"	% of 42'-0"	C.I 23'-0"	% of 42'-0"
Tension	6240	3264	52.3%	1890	30.3%
Moment	60840	22848	37.5%	10395	17.1%

THEORY OF RING ANALYSIS FOR NORMAL PRESSURES



The following computation is based on a method of construction whereby gravel packing is tightly wedged between outside circumference of tunnel and inside of opening left by shield as it moves forward, creating initial normal pressures, which are later modified by the entrance of water into the voids of the packing. The four assumptions, based on observed phenomena and fundamental principles of mechanics, are as follows:

(1) Unit pressure at top of ring equal to weight of material above.
(2) Vertical and horizontal forces in equilibrium.
(3) All pressures normal to surface of tunnel.
(4.) Pressures increase a uniform amount for each added foot of depth.

Let $p - d$ = wt per sq ft. of material above top of tunnel = normal pressure at top.
$p + d$ = normal pressure at bottom. W = wt. of one foot of tunnel
R = outside radius of tunnel, in ft.

Then to obtain equilibrium $W = \pi R d$. (This equation determines d, and indirectly, p.)

By symmetry, shear at top is zero.

Let G = dist. to c g. of tunnel section, A = area of tunnel section per linear foot.
H_0 = thrust at top, M_0 = moment at top, v, h = vertical, horizontal comp. of normal pressure
V, H, N = vertical, horizontal, normal forces at section determined by angle θ.
$v = h = p - d\cos\theta$, acting on elements $R\,d\theta\cos\theta$ and $R\,d\theta\sin\theta$ respectively.

Comp. of V due to wt. of tunnel is $\frac{1}{2}Rd\theta$ and mom about ℄ is approx $\frac{1}{2}GRd(1-\cos\theta)$.

Then $V = \frac{1}{2}Rd\,\theta + \int_\theta^0 (p - d\cos\theta)R\cos\theta\,d\theta = Rp\sin\theta - \frac{1}{2}Rd\sin\theta\cos\theta.$

$aV = \frac{1}{2}GRd(1-\cos\theta) + \int_\theta^0 R\sin\theta(p - d\cos\theta)R\cos\theta\,d\theta$

$= \frac{1}{2}GRd(1-\cos\theta) + \frac{1}{2}R^2p\sin^2\theta - \frac{1}{3}R^2d(1-\cos^3\theta).$

Also $H = H_0 - \int_\theta^0 (p - d\cos\theta)R\sin\theta\,d\theta = H_0 - Rp(1-\cos\theta) + \frac{1}{2}Rd\sin^2\theta.$

$bH = GH_0 - \int_\theta^0 R\cos\theta(p - d\cos\theta)R\sin\theta\,d\theta = GH_0 - \frac{1}{2}R^2p\sin^2\theta + \frac{1}{3}R^2d(1-\cos^3\theta).$

Now $N = V\sin\theta + H\cos\theta = H_0\cos\theta + Rp(1-\cos\theta).$

Also mom. of N about ℄ $= M_0 + aV + bH = M_0 + GH_0 + \frac{1}{2}GRd(1-\cos\theta).$

Applying the Theory of Least Work, we observe that:

(1.) Work done by thrust is constant, and may be neglected without error.

(2.) If values of H_0 and M_0 may be discovered which place N at c g. of section at any point, work done by moment and shear is zero, and therefore a minimum. Such values may be found, and are $M_0 = 0$, $H_0 = R(p - \frac{1}{2}d)$; for substituting these values, we obtain $N = Rp - \frac{1}{2}Rd\cos\theta$, and mom of $N = GRp - \frac{1}{2}GRd\cos\theta = GN$

These values are correct by the most rigid theoretical analysis. Max. value of N is at bottom, where unit compression $f = \frac{R}{A}(p + \frac{1}{2}d)$.

Applying this analysis, we obtain the following table.

Case.	W(#/lin ft)	R(ft)	d(#/□')	p-d(#/□')	p(#/□')	A(□")	f #/□"
I.	55135	21.00	836	5032	5868	432.0	305
II	47360	18.25	828	5032	5860	432.0	265
III.	13560	14.50	298	5032	5330	43.2	1840
IV.	9650	11.50	267	5088	5355	38.4	1645

Pressure diagrams taken in the Pa. tubes conform very closely to this reasoning. Concrete lining increases weight of tubes. Results compare thus:

Observed		11.50	432		5760	38.4	1790
Computed	20000	11.50	553	5088	5640	98.4	1770

COMPUTATIONS.
VEHICULAR TUNNEL.
Made by M.G. Findley, March 24, 1920.

Most of these analyses are given on pages 74 and 75, being photographed from the original prepared for General Goethals by M. G. Findley. The general principles and conclusions would seem to be equally applicable to sewers and other conduits of similar construction.

Jointing Materials for Water Mains*

Fred O. Stevens†

Expenses of water departments in Weymouth, Berlin, N. H., St. Louis, Boston and Atlantic City in the use of "Leadite," Lead hydrotite and similar materials.

The great difference in cost between lead and the non-lead joint materials makes it an obligation on the part of water-works engineers and executives to satisfy themselves as to the efficiency of the non-lead products. Although these materials have been in the market for about sixteen years, and have been used in increasing quantities during that period, they are still regarded by the great majority of water-works men with more or less skepticism.

The facts of the case are that lead has proved to be such an excellent material for joints, and workmen have become so well trained in its use, that engineers and superintendents have naturally and rightly hesitated to substitute for it a substance with which they are unfamiliar, and upon which there is a relatively small amount of data as to its efficiency.

The writer has used the two substitutes known as "Leadite" and "Lead-Hydro-Tite" for over eight years, in various localities and under varying conditions, with very satisfactory results, and as a consequence has acquired a great degree of confidence in them. The water-works profession, however, must be, from the very nature of its work, very conservative in adopting untried methods and materials, and is bound to demand something more than the testimony of a few of its members that a certain thing "works all right, as far as they know."

The purpose of this short review, then, is not to take a partisan stand in favor of any joint material, but to impress upon the members of the Association the fact that these substitutes for lead are worthy of careful consideration and investigation in view of the present prices of lead and labor. It is to be hoped that a general discussion may bring out some new facts and stimulate further investigations.

To the manufacturers the writer would suggest that, having now established the compartively low cost of their products in the minds of the water-works trade, they devote more energy to experimental work, to enable them to answer with definite figures the questions to which a thorough and thoughtful water-works man must have an answer before making what would otherwise appear to him a hazardous change.

The most important of these questions are as follows:

(1) How do joints of these materials compare with those of lead as to tightness under normal conditions?

(2) What of the possibility of blown joints

(3) Will the joint have sufficient strength to resist stresses due to bending moment when support is removed from a considerable length of pipe as a result of settlement of back-fill or nearby excavations for services etc.?

On the first question the writer is able to submit evidence derived from actual experiment. In the summer of 1917 the Weymouth Water Works laid 3,400 ft. of 8-in. pipe, from which no services were taken until the following season. The joints were of Lead-Hydro-Tite, and the new gate controlling this line was by-passed with a ⅝-in. Empire meter testing 99 per cent. in 1-32-in. opening. For the final measurements the flow was too small for accurate measurement by meter and a force pump was used, pumping from a pail into which water was fed by a standard gallon measure. The results as to leakage per linear foot of joint are shown in the following table, and would, according to available data on the subject, be considered excellent for lead joints.

Tests for Leakage from Lead-Hydro-Tite Joints, Idlewell Extension, North Weymouth, Mass.

Date	Section	No. of Joints	Gals. per Minute	Gals. per 24 Hrs. per Lin. Ft. of Joint	
1917.					
July 26	1	75	3.375	26.20	New Joints.
*Aug. 8	1	75	.150	1.16	
Aug. 20	2	180	.322	1.04	Sec. 1 plus 105 new joints.
Aug. 25	2	180	.305	.99	
Sept. 29	2	180	.217	.70	
Nov. 2	1	75	.041	.32	
Nov. 2	2	180	.098	.32	
Nov. 2	3	250	.495	1.15	Sec. 2 plus 70 new joints.
Nov. 2	4	335	3.500	6.16	Sec. 3 plus 85 new joints or entire extension.
1918.					
*June 1	4	335	.150	.26	

Pipe was 8-in. Class E., New England weights. Average pressure, 70 lbs.

Leakage measured by ⅝-in. Empire meter, registering 99 per cent. on 1-32 in. opening at 70-lb. gauge pressure.

*By pump and gallon measure.

This work was done by a man having one season's experience with Leadite, exercising the ordinary degree of care usually required by the writer on this class of work, and the results should give a fair indication of the degree of tightness to be expected under average conditions.

As to the matter of joints blowing out, the writer can only say that he has never known of a Leadite or Hydro-Tite joint blowing out. In fact the strength of these materials and their adhesion to the metal as demonstrated when a joint is dug out seems to be sufficient evidence of their safety in this direction without extensive experiment.

As to the behavior of this type of joint when subject to crushing stresses such as occur when portions of a pipe line are left unsupported by the settlement of backfilling, the writer has been, until very recently, in doubt; in fact, uncertainty on this one point has prevented him from giving these materials his unqualified endorsement as substitutes for lead. This doubt has been pretty much dispelled by the results in a case that has recently come to his attention.

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†Engineer and Superintendent of Water Works, Weymouth, Mass.

*Paper before the New England Water Works Association.

The Berlin Water Company of Berlin, N. H., built last year a new dam from which an 18 in. cast-iron main was to lead to the city distribution system. About two lengths of this pipe were in the dam, and on the end of the first length on the down stream side an 18 in. valve was placed. Joints were all of Lead-Hydro-Tite. Before any more pipe was laid the rservoir was filed and some time later a washout occurred which completely undermined this length of pipe, leaving it and the gate suspended in the air and supported solely by the material in the joint near the masonry. Just what the maximum stresses were in the joint it is neither easy nor necessary to compute, but it seems to the writer that they are as great as are apt to be encountered under ordinary working conditions.

The writer has not attempted to take up the methods of using these compounds, or the minor difficulties attending their use for the first time with inexperienced men and incomplete equipment. These points have been covered in previous papers before the Association and in the literature with which the manufacturers keep us supplied.

It does unquestionably require considerable courage and considerable faith to give up the good old lead and substitute these new materials in the face of the inevitable opposition from calkers and doubt as to the outcome of the first day's work. The point that the writer wishes to make and to urge very strongly, however, is that we water-works managers and engineers cannot, with a clear conscience, go on using and specifying lead, if these other substances are safe and suitable substitutes. And it is "up to us" to find out whether or not they are safe and suitable or to make every possible effort to find out.

The bulk of the evidence, so far, points in one direction,—in favor of the substitutes. In the discussion that is to follow, let us hear from the other side,—the unsatisfactory experiences which, for our present purpose of getting at the truth, are perhaps the most valuable of all.

Several members took part in the discussion of this paper, giving personal experiences with these materials. E. E. Wall, water commissioner of St. Louis, stated that he had found it difficult if not impossible to properly control the temperature of leadite when using a coal fire built around a melting pot, as was used for melting lead, the tendency being to burn the leadite by having the fire too hot. Also, trouble was experienced by the fumes rising from the pouring pot directly into the faces of the men when pouring the joints. This condition was particularly objectionable on the work where leadite was used, because the trench was a narrow and unusually deep one. No cost figures were kept, but Mr. Wall did not doubt that, if properly used by experienced men, the cost of leadite joints would be less than those of lead.

In 1918, Mr. Wall had used metalium for about 1200 feet of six-inch pipe, and the trench was left open for about two weeks to determine the leakage. Immediately after the pipe was laid the leakage amounted to 2¼ gallons per minute, the average during the first 24 hours was 1.3 gallons per minute, and was 1.15 during the second 24 hours. Before the trench was filled, the leakage had stopped altogether. Joints made with metalium in this case did not prove to be as cheap as lead, possibly because the men were unfamiliar with using the material. The last three lengths of pipe laid on this line were on a sharp up-grade of 3 feet in 36, and the change of grade was made at one joint. Afterward this pipe was lowered while under pressure, but no leakage at the joint resulted and no damage to the joint.

Cement was used for jointing about 800 feet of six-inch pipe in St. Louis in 1917. The water pressure on the joints ranged from 90 to 120 pounds per square inch and no leaks developed and no joints showed deterioration when the line was taken up a year later. (This line was used to supply a temporary camp). One bag of cement made 18 joints and twice as much jute was required as for lead joints. Three men mixed and made eight joints an hour. When making lead joints, two men attend to the lead pot, make rolls, run and caulk ten six-inch joints an hour. On the basis of these figures, with cement at $1.75 a barrel, labor at $2.10 and $2.42 a day, jute at 8 cents per pound and lead at 7 cents a pound, the cost per joint figures 98 cents for cement and $1.34 for lead. It was much more difficult to take up pipes with cement joints than those with lead joints.

The Atlantic City Water Department now uses leadite almost exclusively, the practice having been begun in 1901 by William C. Hawley, continued by Mr. Allen, and is now being practiced by Lincoln Van Gilder, present superintendent of water works. None of the joints laid since 1901 have shown any signs of deterioration.

An experiment made with leadite joints by the Boston Water Division was described by Frank A. McInnes, engineer of the department. Four lengths of four-inch pipe and one short piece were jointed with leadite and supported at each end, the supports being 48 feet apart, when the center deflected twenty-two inches, but without leakage or sign of failure. The center of the pipe was then loaded gradually but no leak developed until, under a load of 100 pounds, the pipe suddenly broke in two in the middle at a point 18 inches from the nearest joint. The deflection just before the break was twenty-five inches. Encouraged by this experiment, leadite was used for laying a pipe on a bridge carrying heavy traffic and street cars and therefore subject to serious vibration. This line had been in for five months at the time of this discussion and, although there was more or less dripping from the joints at first, this entirely ceased by winter when it was covered up to protect it from freezing.

The remainder of the discussion was devoted to the question whether leadite joints were conductors of electricity. The author of the paper stated that he had found it an excellent insulator and that he had been unable to get a current to pass through it when endeavoring to thaw pipes by electricity. It was stated that the Boston Water Works had tried using a lead wedge on the bottom of each joint, and the same was used in Springfield. The members from these cities did not know whether the lead wedge was of any benefit, but George H. Finneran, superintendent of water service of Boston, stated that they had made a test in the yard, using volt meters, ammeters and other electrical apparatus. With solid leadite joints no flow of current through them could be observed, but when the joints were remade, using a lead wedge about 2½ inches long, two inches wide and ½ inch thick, placed in the bottom of the joint and driven in solidly, current was found to flow through the joint in amounts varying from one ampere to 400 and 14 volts to 30. However, when a test was made of pipe laid in the ground with leadite joints without lead wedges, current was found to pass through the main, indicating that the soil may have carried the current around the joints. In other cases, the current was found to pass from the pipe to a street railway track and back again, instead of through leadite joints. In another case he found that current passed from one pipe to another through a film or scale of what appeared to be rust, which had formed on the face of the leadite joint. He concluded that such a scale or the ground itself would serve to conduct the current, so that the use of leadite woud not interfere with using electricity as a thawing agent.

Water Filter for Mechanicsburgh

Work was begun the last week in June on a new one-half million gallon filter for Mechanicsburgh, Pa., which is one of the improvements which the Mechanicsburgh Gas & Water Company had been ordered to make by the State Department of Health, following the typhoid epidemic in that borough last February.

A typhoid epidemic in the spring of 1919 was investigated by the Health Department and attributed to the water supply. In February, 1920, a large fire so reduced the supply that the town was without water the following morning and the company turned into the mains water which had been insufficiently filtered, with the result that a typhoid outbreak occurred. In addition to the filter, the company is directed to install an electric emergency pump.

The citizens have been thoroughly aroused by these two typhoid epidemics and ten citizens have agreed to serve as deputy health officers and have been appointed by state commissioner Martin to serve in this capacity. These citizens serve without pay and the work performed by them has proved so satisfactory that commissioner Martin was said to be considering the appointment of similar committees in all of the boroughs of the state. Each week a sub-committee of two visits the water plant, examines the premises, obtains information as to the number of hours the pumps operate and other features of operation; while one of the members, who is appointed official water tester, obtains three samples of water in the borough and sends them to the Health Board for examination.

Elmira's Municipal Water Plant

The water works system of Elmira, N. Y., had been under municipal control for five years on April 3, 1920, and during that time paid out from the earnings $137,178 for additions and extensions and paid off $115,000 in bonds, giving a total gain to the city of $252,178. During the same period rates have been reduced for the small consumers whereby they have saved over $15,000 a year during the past three years. The old minimum charge was $3 per quarter, limited to 1,000 cubic feet. Many householders were using only 500 or 600 cubic feet per quarter and the minimum rate was therefore reduced to $1.50 per quarter for 500 cubic feet.

The $137,178 spent for extensions was used to add 13 miles of mains from 12 inches to 2 inches in diameter, 1,355 new services, for the purchase of a truck for hauling pipe, etc., and a Ford car for the meter department. When the plant was purchased there were in the pumping station a Worthington high-duty, cross-compound steam pumping unit with a capacity of 7½ million gallons per day, and a Worthington electrically driven pump of the same capacity. Both of these pumps had outlived their usefulness and in the second year of the city's ownership they were replaced with more modern units, these being a horizontal steam turbine connected to a centrifugal pump and a single-stage double-suction centrifugal pump with horizontal shaft direct connected to a 300 h.p. 3-phase induction motor. The steam unit has been operated with a saving of coal of more than 20 per cent over the one replaced, and the electric power consumption fell from 85 k.w.h. per 100,000 gallons to 65.

At the filter plant the entire strainer system was replaced, and a liquid chlorine outfit was substituted for a plant for using hypochlorite. The high pressure distributing reservoir was relined in 1916 at a cost of $5,630, and a new concrete spillway and retaining wall were built at the storage reservoir at a cost of over $8,000. All of these improvements and extensions were paid for entirely from earnings.. Over $5,000 has been spent in lowering mains in many sections of the city to prevent freezing and still more of this work must be done before general manager H. M. Beardsley will feel sure that there will be no trouble from frozen mains.

According to the annual report: "Some little objection was made when the city first announced its intention of metering all services, but our records show that the great majority of takers have been benefited by the change and their bills reduced in size by the use of meters. The efficacy of the meter in checking waste is shown by the fact that during the first year of operation 1,602 million gallons were delivered to the city, while in the fifth year, with approximately 10,000 more people using water, only 1,578 million gallons had to be supplied. As a further prevention of waste, the Pitometer Company made a survey of the entire city last fall and all leaks which were discovered were repaired. It is considered that the saving in water formerly wasted will pay for the cost of the survey within a year. The saving thereafter will be reflected in the reduced amount of water pumped and the consequent saving in operation."

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Pneumatic Foundation Without A Caisson

The construction of foundations with pneumatic caissons, although sometimes unavoidable in very difficult bottom, in deep water, or where it is impossible to unwater open excavations, is generally objectionable on account of the slow and expensive work involved, which often gives a very high unit cost for the concrete placed by this method. In recent years the cost of pneumatic caisson work in many instances has been considerably reduced by the successive replacement of the costly steel caissons by wooden caissons and eventually by reinforced concrete caissons which involve the temporary use of very little material not necessary for the permanent structure, and by the use of detachable cofferdams that may sometimes be used repeatedly if there are several successive piers to be built at the same place.

In order to avoid the possible delay in reconstruction and duplication of cost, it is generally customary to begin the foundations with pneumatic caissons where there is reason to suspect serious trouble with open excavation, thus making it necessary to do all of the excavation under air pressure in the working chamber in a manner that is disadvantageous as compared with open excavation.

Very satisfactory and encouraging results have been obtained in several jobs by what is virtually a combination of the open cofferdam and pneumatic caisson method, namely, with the use of the so-called "air bell" as described on page 68 of this issue. In the work here illustrated, and in previous work successfully accomplished by the same contractor in the construction of a bridge across the Tennessee river at Chattanooga, work on the pier foundation was first commenced in an ordinary sheet pile cofferdam and as much of the excavation as possible and part of the concreting was done in the open at a great saving over pneumatic caisson work. When it became impracticable to complete the foundations in the dry on account of serious leaks in the bottom of the cofferdam, light airtight wooden caissons, called "air bells," much lighter, smaller and less costly than ordinary pneumatic caissons, were installed commanding only the difficult parts of the foundations, and were enclosed in concrete deposited under water on satisfactory bottom to seal the cofferdam. This enabled more concrete to be placed in the dry, enclosing and greatly strengthening the light caissons so that they were enabled to withstand air pressure and permit the relatively small amount of work remaining to be done in them under pneumatic pressure at a fraction of the cost that would have been incurred if all of the work had been done under pressure.

Rational Investigations for Aqueduct Design

In designing a costly and important structure, like the $15,000,000 Winnipeg Aqueduct, the simple adoption of standard features and provision of abundant strength based on ordinary assumptions of conditions and requirements does not, alone, secure the best results. With an unlimited amount of time and money they may indeed provide a considerable degree of safety and efficiency, but the conservative copying under new conditions of structures that have been carefully designed to suit other conditions does not suffice for the best results. A clear understanding and careful equating of all the elements of location, conditions, requirements, construction, maintenance, and operation are necessary to assure the results best suited as a whole to the advantage of the owners. To secure these, some risks must be taken and others should be avoided, some advantages should be made to balance other disadvantages. Many points can only be determined by wide knowledge, long experience and careful investigation and analysis of conditions and requirements that require a high degree of skill and good judgment.

This has been notably demonstrated in the design of the Winnipeg Aqueduct of which the principal features are discussed in the articles commenced in the July 3rd issue of **Public Works.** For good and sufficient reasons, it was deemed advisable to make the aqueduct of comparatively light construction, and many miles of it were built with thin walls, arch and invert that effected a very important saving over the heavier construction that would have been necessary with less thorough and careful investigation and design.

Much of the aqueduct is in swampy ground, supported on soft soil where great precautions were taken to prevent settlement that would inevitably have caused expensive and dangerous cracking. Investigations and experiments were very thorough and comprehensive and included many tests of full size inverts of reinforced concrete with different dimensions that eventually determined the dimensions of no less than 16 different inverts that were used at various places and under different conditions.

Some of the auxiliary structures were designed on original lines providing for unusual requirements, such as the protection of the intake from frost in the very cold climate and the proportioning of the arch and side walls of the horse-shoe shape conduit to resist the unusual action of the frost which at a depth of 4 feet from the surface of the backfill was sufficient to expand the frozen crust and lift it entirely clear of the extrados of the arch leaving a lune shape void over the haunches between the concrete and the frozen clay. This occurred at points where the covering was ample to protect the water in the aqueduct from freezing and to maintain in it a temperature that varied only about 1 degree from the summer or winter temperature in the supply lake.

The surge tank designed to relieve the aqueduct from stresses produced by sudden variations of pump pressure, was of special construction with the overflow proportioned to absorb these variations by giving 6½ minutes for speeding up the velocity of flow from 1½ feet to 4 feet per second.

Another Scheme for Selling Bonds

A few weeks ago we called attention to a plan employed by the officials of San Francisco, Cal., for evading state provisions that bonds for their municipal water supply could not be sold below par, the idea being in brief to have the contractors take the bonds at par and then add to their contract, as a sort of bonus, a considerable sum to compensate them for accepting the bonds at a low rate of interest.

The State Highway Commission of California has evolved another scheme for disposing of $3,000,000 worth of 4½ per cent bonds to be used for carrying on the work of that commission, this being for these bonds to be purchased at par by the State Board of Control, that board in turn to sell them to a syndicate of bond brokers at a price which would permit them to realize 5¼ per cent interest on their investment. This would result in a loss of $192,414 to the State Board of Control, which loss would be made good by deducting that sum from the Federal Aid fund. The Court of Appeals decided a few days ago that this method of beating the devil around the stump must be held as a violation of the law, and that the only way in which the state could meet the situation was by having the people at a state election give permission for the issuing of bonds bearing more than 4½ per cent interest.

This failure to raise money may entirely stop all the highway work in the state, since money is necessary for the salaries of the Highway Commission's employees. It is reported that a number of contractors have been performing highway work under "promise to pay" and that they will bring damage suits against the state; but as the Highway Commission cannot legally enter into a contract for work until the money is in hand, it is questioned whether the contractors can recover for such work.

Essentials of Tunnel Design.

Besides geographic, commercial, financial, and economic considerations, the building of a great tunnel involves methods and details of construction operations which are inseparable from an accurate and rational design. This in turn, demands assumption and verification of conditions, accurate analysis and precise computations to determine the stresses involved and the strength and safety of the structure.

In the past these requirements have sometimes been met, or even more or less neglected, by arbitrary or rule-of-thumb methods or by an effort to secure great, but indeterminate strength in hopes that it might exceed the unknown stresses. In the case of the proposed North River Vehicular Tunnel there has been much discussion and some conflicting views have been expressed regarding the conditions to be encountered and the strength and safety of different types of construction proposed. To secure authoritative data, expert computations were made for the report of the consulting engineer recently published in our columns, general formulas were derived and were specifically applied to four different sizes of tunnels which had been proposed, and the possibility of flotation and the longitudinal strength were calculated.

This original work, of a nature not very frequently required in ordinary engineering practice, was thoroughly and carefully done, and was found to agree closely with some of the results obtained by independent calculations of other engineers favoring different construction from that recommended in the report. They also brought out some special analysis and provide a clear and complete investigation that should be preserved for its technical value, as reference, and for direct application to a class of tunnel construction that is likely to increase rather than diminish in future years.

It has long been possible to construct tunnels on land or in solid rock under water, but much uncertainty and danger has attended subaqueous tunneling through silt, sand and treacherous materials. These difficulties will be materially diminished by the cleaver understanding of the conditions here developed and improvements and safeguards can follow that will be of great value not only for railroad and highway tunnels but also for sewer, water, gas and other utility tunnels under rivers and harbors and in other difficult places.

Detroit's 20 Miles of Street Railway

Bids have been invited for the construction in Detroit of about 20 miles of municipal railway to cost about $15,000,000. The bids have been divided into three classes, for foundation work, for oak cross ties, and for all steel work, even including the spikes. The total quantities include about 95,000 yards of excavation, 115,000 square yards of steel rail and 7,000 yards of ½-inch crushed stone back-fill. Work has already been commenced on a portion of this system.

Galveston Causeway

Under provisions of the original contract, the board of managers of Galveston County, Texas have relieved Larkin & Sangster, Inc., Buffalo, N. Y., of their contract for constructing the causeway in accordance with the clause that permitted this action should the cost exceed $1,750,000, which it has done. The increasing cost of materials, labor and transportation have made it impossible to complete the contract within the bids but the work will be continued under the direction of H. F. Jones, the supervising engineer.

Waterworks Prices in 1914 and Now

Figures from waterworks officials, supplementing those given in the June 12th issue.

Since publishing, in the issue of June 12, figures from more than 100 waterworks officials in 36 states giving prices paid by them for waterworks supplies in 1914, 1919 and 1920, we have received reports from several additional cities which we give tabulated below.

PRICES PAID FOR CAST IRON PIPE

City and State	Average Price per Ton Paid in		
	1914	1919	1920
Connecticut:			
Rockville	$[illegible].00	$56.30	......
Kentucky:			
Covington	......	......	$70.50
Maine:			
York	21.70	......	......
Michigan:			
Detroit	21.45, 23.45	50.90-63.60	45.00
Minnesota:			
Ely	......	69.78	......
New Hampshire:			
Concord	22.00	......	......
New Jersey:			
Jersey City	21.00	47.25	......
New York:			
Frankfort	21.00	......	......
North Carolina:			
Statesville	......	48.50	......
Pennsylvania:			
Harrisburg	20.74	49.85	76.80
Texas:			
Sulhpur Springs	27.00	64.00	90.00

PRICES PAID FOR SPECIAL CASTINGS

City and State	Average Price per Pound Paid in 1914 Cents	1919 Cents	1920 Cents
Illinois:			
Olney	3-4½	......	......
Kentucky:			
Covington	......	......	7½
Michigan:			
Detroit	2¾	8½	8¾
New Jersey:			
Jersey City	2¼	5.95	......
New York:			
Frankfort	2¾	......	......
Pennsylvania:			
Harrisburg	2½	5½	7¾
Texas:			
Sulphur Springs	3	......	7½

PRICES PAID FOR WROUGHT IRON OR STEEL PIPE

City and State	Unit	Average Price Paid in 1914 Cents	1919 Cents	1920 Cents
California:				
Upland	Pound	5	9	9
Massachusetts:				
Pepperell	100 ft. wr. iron	..	16.15	17.85
Nebraska:				
North Platte	Ft. 2-in. pipe	15	....	30
Plattsmouth	1-in. ft.	9	12	12¾
North Dakota:				
Dickinson	Ft.	80	188.75	.....

PRICES PAID FOR LEAD

City and State	Average Price per Pound Paid in 1914 Cents	1919 Cents	1920 Cents
Connecticut:			
Rockville	4¾	10	......
Kentucky:			
Covington	6	11	11¼
Maine:			
York	4	6.70	......
Massachusetts:			
Pepperell	......	......	8
Michigan:			
Detroit	3.75	6.25	......
Minnesota:			
Ely	......	8½	......
Nebraska:			
Plattsmouth	9¾	11½	......
New York:			
Frankfort	4½	6¾	......
Ohio:			
Celina	8½	10½	11½
Texas:			
Sulphur Springs	6	8	9½

PRICES PAID FOR METERS, ¾ INCH

City and State	Average Price Paid in		
	1914	1919	1920
California:			
Ontario	$7.90		$11.60
Upland*	[illegible]	$11.00	11.50
Connecticut:			
Rockville	[illegible]	[illegible]	15.30
Illinois:			
Olney	13.50	17.50	......
Michigan:			
Detroit	7.72	[illegible]	9.95
Minnesota:			
Ely		11.00	......
Nebraska:			
North Platte	[illegible]	[illegible]	
Plattsmouth*	[illegible]	12.00	......
New York:			
Frankfort	[illegible]	12'50	......
Pennsylvania:			
Harrisburg	9.00	[illegible]	14.50
Texas:			
Sulphur Springs	[illegible]	[illegible]	12.00
Wisconsin:			
Watertown*	[illegible]	[illegible]	12.00

*⅝ inch meters.

PRICES PAID FOR VALVES, 6 INCH

City and State	Average Price Paid In		
	1914	1919	1920
California:			
Upland	$12.00	$14.00	$15.[illegible]
Connecticut:			
Rockville	11.00	21.00	......
Kentucky:			
Covington	......	......	[illegible]
Maine:			
York	11.00	......	......
Michigan:			
Detroit	12.75	[illegible]	......
New Jersey:			
Jersey City	10.00	......	25.00
New York:			
Frankfort	12.50	20.00	......
Pennsylvania:			
Harrisburg	9.45	20.79	25.00

PRICES PAID FOR HYDRANTS, 2-WAY AND STEAMER

City and State	Average Price Paid in		
	1914	1919	1920
Illinois:			
Olney	$18.60	$35.00	......
Kentucky:			
Covington	25.00	38.00	$39.80
Maine:			
York	33.50	61.10	......
Massachusetts:			
Pepperell	......	65.00	(2 way) 64.40
Minnesota:			
Ely	......	52.75	62.50
Nebraska:			
Plattsmouth	......	......	50.00
New Hampshire:			
Concord	24 & 34	65	......
New Jersey:			
Jersey City	......	82.50	......
New York:			
'Frankfort	32.00	45.86'	......
North Dakota:			
Dickinson	55.00	80.00	......
Pennsylvania:			
Harrisburg	23.85	55.60	66.50
Texas:			
Sulphur Springs	21.00	38.00	43.00

PRICES PAID FOR COAL

City and State	Average Price Paid in		
	1914	1919	1920
Delaware:			
Milford	$4.00	$8.00	$8.41
Illinois:			
Olney	2.35	4.65	5.10
Michigan:			
Detroit	2.51	5.19	6.18
Minnesota:	2.29	5.61	8.06
Ely	3.55	5.10	5.10
Nebraska:			
North Platte	3.75	......	5.60
Plattsmouth	2.50	5.00	5.75
New Hampshire:			
Concord	9.00	13.00	14.00
North Dakota:			
Dickinson	1.94	3.80	3.80
Ohio:			
Celina	2.25	3.80	6.05
Pennsylvania:			
Harrisburg	.85 & .95	1.65 & 1.85	2.10 & 2.50
Texas:			
Sulphur Springs	3.75	5.25	6.50
Wisconsin:			
Watertown	3.95	6.48	7.88

PRICES PAID FOR FUEL OIL

City and State	Average Price per Gallon Paid in 1914	1919	1920
Massachusetts:			
Pepperell	......	$0.13¼	......
New Hampshire:			
Concord	......	.28	$0.34

PRICES PAID FOR ELECTRIC CURRENT FOR POWER

City and State	Average Price per k.w. hour Paid in 1914	1919	1920
California:			
Ontario	$0.05	......	$0.02 7-9
New Hampshire:			
Concord	.12	$0.12	.12
North Dakota:			
Dickinson	.02½	.02½	.04
Ohio:			
Celina	.03½	.04	.05¼

PRICES PAID FOR LIME (FOR PURIFICATION PLANTS)

City and State	—Aver Price per Pound Paid in— 1914	1919	1920
	Cents	Cents	Cents
New Jersey:			
Jersey City	2 1-5	2.8	2.508
Pennsylvania:			
Harrisburg	1.70	3.00	......

INCREASES IN WATER RATES, SALARIES AND WAGES

City and State	Percentage of Increase Since 1914		Increase in water rates since June, 1919
	In superintendent's salary	In wages of other employees	
California:	%	%	
Ontario	..	100	None
Upland	25	..	None
Connecticut:			
Rockville	..	38	None
Delaware:			
Milford	50	50	75%
Illinois:			
Olney	30	15	6%
Kentucky:			
Covington	50	50 engr. 30 others	None
Maine:			
York	25	100	None
Massachusetts:			
Pepperell	14	40	.....
Michigan:			
Detroit	38	25-100	None
Minnesota:			
Ely	52	50	None
Nebraska:			
North Platte	60	66-100	20%
Plattsmouth	..	60	.....
New Hampshire:			
Concord	..	..	125%
New Jersey:			
Jersey City	16	40	None
New York:			
Frankfort	..	50	None
North Carolina:			
Statesville	50	..	None
North Dakota:			
Dickinson	10	20	None
Ohio:			
Celina	40	50	20%
Pennsylvania:			
Harrisburg	20	50-100	None
Teaxs:			
Sulphur Springs	65	100	None
Wisconsin:			
Watertown	50	50	None

Garbage Disposal in Charleston, W. Va.

A special committee of the Chamber of Commerce has submitted a report dealing with the garbage problem of the city, the recommendation in which report may be summarized as follows:

1. The Charleston chamber of commerce recommends to the city council that negotiations be entered into at once with some reliable companies looking toward a contract for free garbage and rubbish collection and disposal for the city.

2. That as early as indications point to any favorable bids being submitted, a committee be appointed by the mayor to draft an ordiance requiring the householders to make proper separation of garbage and rubbish and to take such further care of it on his premises as may be of help to the collector, and to city sanitation.

3. That negotiations be entered into by the proper city authorities looking to the sale of the Estill street garbage plant

4. That we recommend the hog feeding as the most economical method of reclamation of our garbage at this time, and that we recommend a plant that will reclaim all valuable products from rubbish.

5. That if possible, a contract be entered into for a period of three years, with an optional extension to the company of another four years.

6. That the percentage or remuneration shall increase from a point below reasonable profit for the first year, to a corresponding point above for the third year, and for the remaining four years a reasonable mean be established.

7. That the contracting company shall give a commercial bond in the sum of $25,000 for faithful performance of their duty.

8. That at a proper time an ordinance be drafted to establish a sanitary type of garbage wagon, time of collections, and daily reports on a chart at the disposal plant showing the amount of service on each street and this chart to be kept by a representative of the health department.

9. That an ordinance be drafted giving a minimum punishment for throwing garbage over any river bank or in any unauthorized place, of five days in jail, or $25 fine, or both at the discretion of the court.

10. That the spirit and letter of our state laws may be not transgressed in that the contracting company shall charge the householders, in the years after the first, rates sufficient to total the remuneration agreed upon. But the city should reserve the right and be honor bound to pay for the service out of the budget for each succeeding year after the first.

The largest single furnace incinerator in the country is now in Galveston, according to W. B. Vinson, superintendent of garbage and drayage. It is a modern plant in every respect. It has shown a capacity of forty tons every twenty-four hours. The old incinerator will be rebuilt so that the city will have the service of two plants.

A proposition is before Congress for the provision, in successive years, of a total sum of $350,000,000 for the reclamation of unused lands in the west and south.

A $90,000,000 Water Supply Project

The East Bay, Cal., Water Commission, recommends construction of a 127-mile aqueduct to the Eel river to supply 250,000,000 gallons of water daily to the cities of Oakland, Berkeley, Alameda and Richmond, with an aggregate population of 370,000 people.

This system is considered a desirable alternative to that of joining with San Francisco in the Hetch-Hetchy proposition.

Chief Engineer Philip E. Harroun reports in favor of a system comprising a storage dam, diversion dam and a 127-mile aqueduct including 30 miles of tunnels, 6 miles of concrete conduits, and 91 miles of steel and concrete pipe with a subaqueous crossing 2 miles long and 600 feet below the surface of Sarquinez strait. It is estimated that this system will cost at least $56,000,000 less than the proportionate share of the cost of the Hetch-Hetchy system, and that the cost of $90,479,000 can be reduced to $82,229,000 by the development of hydraulic power from the supply.

Bridge Work in Rumania

Owing to the general destruction of bridges during the war, there is an exceptional opportunity for American bridge builders in Rumania. There are eighteen important bridges to be reconstructed besides the great bridge over the Danube at Lernevoda, known as the King Carol bridge, 1,260 feet long and 11.4 feet above high water. In addition it is planned to erect a bridge over the Danube to connect Rumania with Serbia.

Concreting Plant and Operations*

By Frank W. Skinner

A general review of advanced practice in field operations, and equipment for important concrete construction. Principal methods of loading, unloading, transporting, storing, reclaiming, and delivering cement and aggregate. Measuring and mixing cement and aggregate, character and installation of mixer, delivery of concrete from mixer to forms, methods and apparatus for distribution and placing.

HANDLING CEMENT

Cement is delivered for the job in bags by rail, by boat, and by automobile trucks and, with the exception of small quantities for daily supply, should be stored in a weather-proof building on a platform elevated beyond danger of moisture from below. One-story wooden sheds 20 to 40 feet wide are often built for the purpose and may frequently be so advantageously located that the cement is unloaded by hand on the floor and can be delivered by hand carts or through chutes to the mixing machine. If the storage house is not adjacent to the railroad and large quantities are to be handled, it will often be advisable to install some sort of loading or conveying apparatus to handle the bags; for this purpose belt conveyors, derricks with skips or large buckets, or locomotive cranes are most frequently available. Sometimes the cement can be stored in a building forming part of the permanent construction, where it is usually handled direct from cars or trucks or brought into a lower floor on carts or wheelbarrows and piled by hand.

In some cases economy is effected by purchasing the cement in bulk, in which case it is usually shipped in box cars like grain, or in open-top cars thoroughly protected by tarpaulins. It can be unloaded by hand shoveling which, however, is very dusty and disagreeable, or by means of a mechanical shovel or scraper operated by power to transfer it a short distance to the storage bins. Open top cars may be unloaded by a clam-shell bucket operated by a derrick and delivering to adjacent storage bins.

The cement storage bins may be adjacent to or independent of the aggregate bins and should have an inclined bottom provided with one or more gates and chutes or spouts delivering by gravity to the batch container or directly to the mixer. A convenient form of outlet has a double valve with reciprocating parts so that, when one gate is closed, the other is open, and the required quantity for one batch is thus automatically measured and delivered by each operation of the controlling lever. A vent pipe is sometimes extended upwards from this apparatus to prevent the formation of a vacuum in the valve. Bulk cement may be elevated to the storage bins by bucket elevators operating in a boot on or near the car or boat; and bag cement may be conveniently handled in a horizontal or inclined position by endless belts, or in vertical or inclined position by bucket conveyors.

TRANSPORTING AND HANDLING AGGREGATE

Sand, broken stone and gravel are all handled and stored in substantially the same manner and all of them may be purchased, secured by the constructor at a remote point, or sometimes produced on the job. If the job involves excavation, such as tunneling, canal, reservoir and some kinds of road work, the stone encountered, if of suitable quality, can be broken to size in a portable crusher, elevated in a bucket elevator to a series of revolving cylindrical screens that deliver it according to size to different elevated bins, from which it is removed as required to general storage or to the mixer plant.

Sand, which may be derived directly from the excavation, can be treated in the same manner and may or may not require screening. In some cases it may have to be mixed for grading or may require washing, and for these purposes special apparatus can easily be designed and applied.

Gravel may also be derived from excavations on the work, or from a remote bank. It may or may not require washing or screening and, under certain circumstances, it may be found with sufficient fine material to serve both for stone and sand, requiring only the addition of cement to make concrete; but this is an unusual occurrence and requires close and constant attention to see that the quality and proportions remain satisfactorily constant. Frequently sand and gravel can be dredged with a clamshell bucket or dragline scraper in the bottom of a river, lake or pond and delivered by the dredge directly to the washing and screening apparatus; here it is cleaned and classified for the required purpose and finally delivered, usually by gravity or by gravity and bucket conveyors, to the storage bins.

The cost of the aggregate is a very important element on a concrete job, and the source, transportation and handling should be carefully investigated before any plant is installed or system adopted. Various systems have been well perfected and much standard equipment can be secured, all of which should be compared and the advantages and disadvantages of the different systems, or of a combination of systems, should be carefully studied. Estimates should be made, and the final plans should give due consideration to the rapidity of the work, the availability of different kinds of equipment and the salvage value after the work is finished. Preference should be given, of course, to well established methods and standard plants, rather than to untried or experimental features; but the engineer should have sufficient experience and ability to combine, modify or adapt, and even to invent, if the available systems or apparatus are not satisfactory, or if special details are necessary.

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*Paper by Frank W. Skinner, published in Cornell Civil Engineer, April, 1920.

The ultimate criterion must, of course, be the total cost of the finished work, unless the latter be subordinated to special considerations of rapidity or coordination with other parts of the work; these principles govern the mixing and distribution of the concrete as well. It may in some cases be more advantageous in the end to do a large amount of hand work, where there is available labor that is otherwise idle, or where it is desirable to keep a large force on hand to maintain the organization or provide for emergencies, or where slow work is preferable to rapid, or where it is difficult to obtain the necessary mechanical equipment.

It may also be more advantageous to pay a large unit price that does not involve much waste, deterioration, or heavy investment in special machinery or perishable equipment, rather than to install an elaborate or costly plant that will take a long time to erect and is not readily salable or useful afterwards, even though the operating cost per unit of concrete is very small.

Plant that is on hand should be utilized if practicable without too serious inefficiency, and the selection of new plant should largely be influenced by the ease and rapidity of securing and disposing of it, its salvage value, and its probable value to the owner for future work, thus making standard appliances always preferable. The cost of storing and transporting plant and the probable cost of maintenance and repairs, as well as the possibilty of renting it from other builders or of letting it when not in use, is also to be considered.

In all operations where a suitable location and arrangement can easily be secured, the movement of materials by gravity will generally be found advantageous even if it necessitates, as it generally will, hoisting materials in one way or another to a considerable height.

The greatest efficiency and economy is attained when the aggregate can be handled directly and continuously, for the minimum horizontal and vertical distances, from the source of supply to the mixing machines without interruption for rehandling, save for the maintenance of efficient permanent storage to insure against delays, breakdowns and interruptions.

STORING AGGREGATE

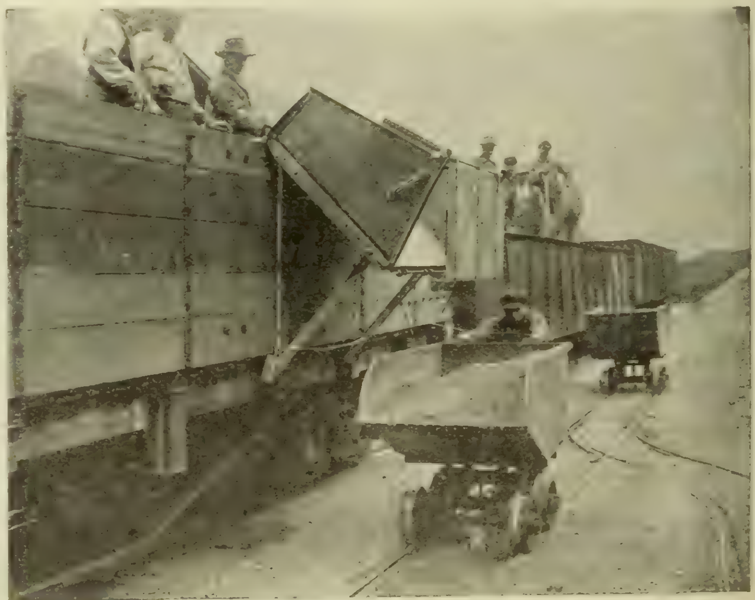
Cars, gondolas, scows, barges and the like are usually unloaded by clamshell buckets operated by derricks or by cableways. The clamshell buckets may deliver directly to storage bins or to storage piles, whence the material is reclaimed, sometimes, by the same buckets filling loading-hoppers, from which trucks are loaded at ground level.

When the aggregate can be delivered in bottom dump cars, the latter can discharge to the boot of a bucket elevator delivering directly to the bins, and it may be provided with a butterfly valve, enabling sand and gravel or broken stone to be shifted from the same elevator to either of two or three bins.

If possible, the storage should be located on a side hill where the material is delivered at a height sufficient to enable it to be moved from storage by gravity. When this cannot be arranged, it is often good policy to build an inclined track on a timber trestle high enough to afford sufficient storage for the aggregate on the surface of the ground below or, what is often more convenient, to enclose the sides of the trestle with heavy planking forming a bin underneath the track, that is filled directly from the cars above. This bin should be provided with bottom gates for the delivery of the material as required.

When the material is stored on the ground, whether it is delivered by trucks, derricks, cars or otherwise, it may, in case of side hill storage, be piled up against a wooden bulkhead on the lower side that will enable it to be drawn off through gates; or it may be piled up against a bulkhead on level ground that will afford the same opportunity to a lesser degree. When delivered by automobile trucks, it is possible to build up a plank runway on the slope of the material and drive the trucks to the top of the pile, thus securing a large storage in one place.

One method of loading which is often found very convenient and economical is to excavate a narrow trench across the ground where the storage pile is to be made, install a narrow gage service track in the trench and cover the top of the trench with a plank floor in which gates are set at intervals corresponding to the distance apart of cars, center to center, in tiling on the service track. The material is then piled to any convenient height over the trench, and cars on the service track can be filled by gravity. This method involves shoveling or other rehandling to deliver material from the outside of the lower part of the storage pile.



SHOVELING AGGREGATE INTO PORTABLE QUICK UNLOADING CHUTE

Sometimes aggregate is delivered to the top of a storage pile by a four-wheel skip hauled on an inclined railroad. Sand and gravel have, in some cases, been transported for several hundred feet to storage piles or bins by water carriage through pipes or wooden flumes. When it is necessary to unload open top cars by hand, portable chutes can often be used to advantage. These are light steel troughs that can be hooked on the upper edge of the car and project over a truck or cart on the ground below. They are wide enough to accommodate two or more shovelers, and their length and inclination are sufficient to deliver the material rapidly to the truck at a convenient distance from the track and reduce the work of shoveling to a minimum.

Where it is necessary to take aggregate from the storage pile on the ground, a good result can often be obtained by a mechanical loader, of which there are several types, the general principle being that of an inclined bucket elevator mounted on wheels and operated by electricity or gasoline. The bucket elevator can be elevated or depressed, so that when the machine is backed up against the face of the storage pile the bottom buckets will engage the toe of the material and carry it to the top of the incline, where the reversing buckets dump it into the car or truck which the elevator overhangs.

DELIVERY TO MIXER

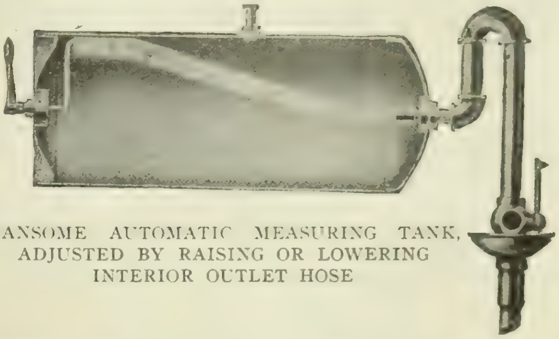
When the mixer can be advantageously installed adjacent to the storage, and the latter can by gravity, deliver directly to the charging hopper, the conditions are then most favorable for rapid and economical work. If this cannot be arranged, it is very desirable to establish a secondary storage at the mixer with a capacity for at least a half day's work, so that mixing can be carried on continuously irrespective of slight irregularities in the delivery from the main storage. The latter should of course have capacity sufficient to continue the work over any period where there is likely to be any interruption of supply due to the weather, transportation difficulties, labor troubles or plant break-downs.

When the main and secondary storage are not more than a few hundred feet apart, it will probably be advantageous on very large work to install some sort of continuous or semi-automatic delivery, such as endless belts, balanced inclines or, if possible, gravity spouting. If these are not practicable, resource will have to be made to some sort of car transportation, or to hauling by hand, team, automobile or locomotives. Delivery to the second bin should be so arranged that the aggregate from it can be drawn by gravity into the charging hopper, and this bin may be filled by any of the methods suitable for the main storage bin.

SKIP CAR FOR HAULING AGGREGATE UP INCLINE

If dump cars can be used, they are preferable; but when not available, flat cars may be used with detachable bodies, or independent skips, or buckets that can be handled by the derrick. In this case it is often desirable to have the bodies, buckets or skips accurately proportioned for the exact amount of aggregate necessary for one batch of concrete, so that they may serve as measuring boxes and may be emptied directly into the charging hopper; this saves rehandling, and maintains the contents of the secondary bin as a reserve using it only when there is an interruption of the supply direct to the mixer.

Wooden measuring boxes can usually be made to advantage by the contractor himself, of design and proportions suited to the special requirements of the work. They may be made with separate divisions for stone, sand and cement; or they may have one or two adjustable interior marks, suited to different proportions for one batch. A number of such boxes loaded on a train of flat cars and passing under the spout of the storage bin can be very rapidly filled with the successive materials. When an automatic measuring device is applied to the cement chute, only one mark or gate is necessary in a batch box. This may be placed low enough in the box so that the bottom is filled with sand up to that level, after which the box is put under the cement bin, and the required quantity of cement is automatically discharged into it without special measurement. Then the box is taken to the stone bin and filled completely full with stone or gravel. There are many different patterns of standard cast iron and steel gates for delivering stone, sand and cement, and it will usually be profitable to install them; but in case of necessity a contractor can easily arrange a gate, made of steel plate and timber frame, that will work very well. Water should be delivered to the mixer drum, after the dry aggregate and cement are charged by an adjustable measuring tank with provisions for heating, if necessary in cold weather.


RANSOME AUTOMATIC MEASURING TANK, ADJUSTED BY RAISING OR LOWERING INTERIOR OUTLET HOSE

(To be continued)

To Irrigate 1,750,000 Acres

The Northwest Reclamation Congress, which will meet in Seattle September 16 and 17, will be the greatest irrigation congress in the history of the Pacific northwest. The congress will probably stress the necessity of developing the great Columbia Basin project of 1,750,000 acres, the most stupendous irrigation proposition in the history of the nation, which will increase by more than half the total taxable wealth of the state of Washington.

New Water Supply Works of Winnipeg*

By James H. Fuertes

This installment describes the surge tank, and gives a brief review of the completed works previously described in detail.

PROTECTION OF LINE FROM STRAINS DUE TO SURGING

An inspection of the diagram in connection with the variations in rates of draft between minimum and maximum rates shows that provisions had to be made to protect the portion of the aqueduct betweent station 900 and Winnipeg against excess pressures due to surging of the water in response to changes in velocities of flow caused by more or less sudden variations in draft, particularly when the booster pumps at Red river would be thrown in or out of service. These pumps are to be installed with a capacity of 50 million gallons daily, so that pumping can be done at a rather high rate for short times daily rather than be continuous. The storage capacity of McPhillips street reservoir makes this feasible and simplifies the pumping machinery.

In order to limit the excess pressures from the above causes, the aqueduct has been connected to a stand-pipe with an overflow with its lips at elevation 785.5, a height somewhat greater than required for the delivery of 28,500,000 gallons daily into McPhillips street reservoir by gravity; and an overflow has been placed on the gravity flow section at station 900+30 with its lips at elevation 797.60. The last mentioned overflow will protect the gravity flow aqueduct to the east of the 8-foot diam. circular pressure section, and the two overflows, combined, will prevent excessive pressures in the portion between station 900 and Red river.

THE SURGE TANK

The surge tank is a reinforced concrete structure, circular in plan, containing a central well, into which the aqueduct discharges, 25 feet in diameter and with its top edge at elvation 785. This well is inside of, and concentric with, a second concrete well 32 feet 6 inches inside diameter, with its top carried up to support a reinforced concrete roof, the under side of which is at elevation 294.75, or 9 feet 8 inches higher than the overflow lip.

Both of these circular wells are carried on a heavy circular concrete base some 8 feet in thickness, resting on a grillage of reinforced concrete and heavy steel beams encased in concrete, carried on eight concrete piers, extending to solid rock about 34 feet below the inside bottom of the surge tank proper. Surrounding the whole structure, and separated from it by an annular space 2 feet 9 inches wide at the bottom reducing to 9½ inches at the top of the structure, is a brick facing with stone base, belt courses and cornice. This design is primarily due to the necessity of conserving the heat of the incoming water in order to prevent the freezing up of the first annular space when overflows take place in winter weather. The water overflowing the inner circular well escapes to the river through a 36-inch cast iron pipe line.

The original calculations showed that a tank 20 feet in diameter would be large enough to limit the extreme downward surge to a practicable limit, under the assumption of a discharge at the rate of 18.9 million gallons daily into the tank being suddenly increased to a discharge of 51 millions daily by throwing in a booster pump of that capaity. This proceeding would increase the velocity in the 5-foot 6-inch pipe line from 1.47 feet per second, prevailing before the booster was started, to 4.00 feet per second when full discharge was established. An analysis by a process of arithmetic integration at 20-second intervals of time indicated that the lowest dip of the surge reached an elvation of 751.1, and then started to rise again about 6 minutes 20 seconds after starting the pumps. The low point was about 2.3 feet below the final level for a continuous discharge at a velocity of 4 feet per second. The maximum discharging velocity 4.1 feet per second, was reached in about 8 minutes 20 seconds after starting the pumps. The upward surge from the low point was not followed out in the analysis; neither was the surge from sudden shutting down of the pumps, which would be the maximum to be expected, as these would be entirely checked by the spilling of the water over the overflow lip.

The original plan was for the use of a 5-foot steel pipe line from Deacon to Red river and a 4-foot cast iron pipe from Red river to McPhillips street reservoir, and to pump the water from Deacon to Winnipeg at service pressure. As has been pointed out, this plan could not be followed out on account of the conditions in the Districts' Act of Incorporation, although, of course, the pipes could be used as recommended; but as the new conditions did not require such strong pipes, studies were made which showed that reinforced concrete pipes could be substituted for those originally proposed, and a new plan of operation be evolved which would reduce the cost of construction and operation while at the same time providing for the delivery of larger quantities of water to the McPhillips street reservoir by gravity. This change was submitted to Mr. Hering and Mr. Sterns, of the original board of consulting engineers, and had their approval.

GENERAL DESCRIPTION OF COMPLETED WORKS

Reviewing the subject, it will be seen that the works constructed include the following:

1. Intake at Indian bay.
2. Venturi meter in the depressed section under Falcon river, about a mile from the intake.
3. Gravity flow aqueduct on various grades, capacity 85 million gallons daily, from Indian bay to Station 900, a distance of 80.54 miles, with a connection at Station 4,618+10 (Mile 87.5) for a second aqueduct in the future.
4. 8-foot circular reinforced concrete aqueduct, built in trench, from Station 900 to Deacon (Sta. 678+72.5), a distance of 22,127.5 lineal feet (or 4.2 miles), running in service un-

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*Continued from page 60.

der heads of from 10 to 30 feet; capacity 85,000,000 gallons daily.

5. Venturi meter in 8-foot pipe line, then offtake pipe to Deacon reservoir, then 5 foot shut-off gate in aqueduct, then intake of 5-foot 6-inch line from Deacon reservoir, then Venturi meter on 5-foot 6-inch line. These two meters, the two offtakes, and the shut-off gate in the 5-foot 6-inch conduit, are all in a stretch of 294.5 feet of aqueduct, measured along its center line.

6. Then a 5-foot reinforced concrete pipe from Deacon to the surge tank at Red river; total length 49,900 feet, delivering water to the surge tank at the maximum practicable rate of 59 million gallons daily from Station 900 to the 36-inch outlet connection for Transcona, 56.5 million gallons daily to the 36-inch outlet connection for St. Boniface and St. Vital, and 35 million gallons daily from St. Boniface to the surge tank. A 24-inch outlet, also, is provided at Archibald St., for the Elmwood district and East Kildonan.

7. The surge tank at Red river.

8. Tunnel under Red river, with connections at the top of the east shaft for the booster pump which will, later, pump water from the surge tank to the McPhillips St. reservoir in quanities up to 35 million gallons per day, but at rates up to 50 million gallons per day.

9. 36-inch connection at top of west shaft of tunnel for a future supply of water to the high bank of Red river, where the west shaft of the tunnel is located, and a 24-inch connection for Fort Garry.

10. A 48-inch reinforced pipe from the Red river tunnel to McPhillips St. reservoir in Winnipeg, with a 24-inch outlet at King St. for Kildonan and a 24-inch outlet for Assiniboia at Arlington St. In this pipe line a Venturi meter has been placed just before the pipe reaches McPhillips St. Reservoir.

The capacity of the 48-inch pipe line and 5-foot 6-inch line, acting together to deliver water by gravity to the McPhillips St. reservoir, is 28.5 million gallons per day at the maximum rate of consumption, which will be reached when the total consumption from this center approximates an average rate of a little over 20 million gallons per day. When that time arrives, the booster pumps at Red river will be required and quantities representing average daily rates up to 15 million gallons above the 20 millions will have to be pumped to McPhillips St. at rates approximating 50 million gallons per day, to keep the reservoir replenished.

As has been stated above, when more than 25 million gallons daily is required in Winnipeg, Kildonan, Assiniboia and Fort Garry, the additional quantity is to be pumped from a proposed new reservoir to be built at St. Boniface. Stop-plank chambers and overflows, as well as blow-offs, have been put at all the principal river crossings and at the end of the gravity flow aqueduct at Station 900+30, in addition to the large gates in the intake structure for the purpose of regulating the rate of flow in the aqueduct as required, and to prevent upward pressure on the roof or arch of the aqueduct in case of accident of any kind.

Labor Notes

The general contractors of New Orleans refuse to pay the $1 per hour wages demanded by the striking unions, and have advertised for 1,000 carpenters to work on open shop basis. Gov. Parker awarded a scale of 90c per hour for the first three months, 95c per hour for the next three months, and $1 an hour for a year thereafter, but it is not acceptable to employers.

The strike of the Providence hodcarriers and building and common laborers' unions in Providence, which has been in progress since May 1, has recently been settled by the intervention of the Building Trade Council. The officers of the laborers' union were restrained by a court order from taking an active part in the conduct of the strike and the Building Trades Council urged the acceptance of the offer of 60c and 65c an hour made by the Master Builders' Association. The unions demanded 70c and 75c but eventually accepted the 60c and 65c offered.

Advices from Cleveland, where there has been recently much labor trouble and very high prices, state that at the recent annual conference of the independent sheet, tin-plate, and bar iron manufacturers with representatives of the Amalgamated Association of iron, steel and tin workers, the radical demands of the latter, not for hours or wages but for unionization of the mill crafts tending to create closed shop and extend sympathetic strikes, have been refused by the employers and that it is likely, and that many manufacturers are now making their plans with the expectation, that the steel and iron mills will be closed on July 1 and August 1 when their respective wage agreements terminate.

Many large industries are said to be leaving Chicago and locating in Omaha and Kansas City because the labor conditions are better in the latter places, and because the compensation laws, taxes and financial matters in Chicago make excessive demands on the large firms, thirty of which are said to have moved west from Chicago during the past year.

Pay According to Efficiency Increases Production

Experiments conducted by a New Bedford, Mass., cotton manufacturer resulted in a 40% increase of output by installation of piecework system in every job on which it is practicable. The mill runs on an eight-hour day.

"Moral Strike Support"

In a recent article the Boston Herald justly scores the American Federation of Labor for its treasonable declaration at the Montreal Convention of "Moral support" and "endeavor to obtain their reinstatement, for the striking Boston Policemen." The Herald commented on the tremendous public approval showed to Gov. Coolidge's action in discharging the policemen by giving him an unprecedented majority in his subsequent re-election, and thinks that the federation's defiance of public.

sentiment will be unequivocally answered at the polls next November by the election of Coolidge which can only be interpreted as endorsement of his honest and loyal records and an assurance that the popularity of unjustified strikes is very small.

Governor Parker of Louisiana, acting as arbitrator of industrial canal workers' demands, has allotted 90c an hour for next three months; 95c an hour for following three months, and $1 an hour for a year thereafter; ruling affects about three thousand workmen.

Although the proportion of immigrants that land in New York City is less now than formerly, the records show that from January 1st until June 27th, the arrivials here totaled 152,987 and that the maximum daily number of 6,200 was considerably in excess of the facilities for caring for them, so that Commissioner of Immigration Fred A. Wallis was obliged to demand from the secretary of labor, authority to add 20 more inspectors and 20 more guards for immediate service.

Increased Immigration Expected in The West

The director of traffic of the Southern Pacific Railroad Company states that the company is preparing for a very large immigration, has reopened its European offices, and is making special efforts to interest Europeans in American prospects and conditions. It is believed that whenever the transportation is adequate there will be marked increase of laborers, and agricultural workers will probably be willing and glad to work for more reasonable hours and rates than now prevail.

The Immigration Wave

On July 13th there arrived at Ellis Island 10,132 European immigrants, the majority of whom came from Italy and other Mediterranean countries, with a few from Great Britain and some from Holland who had escaped to that country during the war. There are plenty of immigrant women, and as none of them apparently intend to do housework, but are going to the factories, they may release some of the men there for agricultural and construction services, so much needed.

Boosting Municipal Wages

Last May the city of New York raised the wages of common labor to $5 per day, and now Local Union 94, composed of city employed laborers, demands that the wages be again increased to $7 per day for such work as watchmen, caretakers and other common labor.

Closed Shop Won't Help St. Louis Carpenters

The Building Industries Association, composed of contractors employing half of the 4,000 carpenters in St. Louis, has announced that pending settlement of the strike of union carpenters who were refused their demands of a raise from $1 to $1.25 per hour, they will employ only non-union carpenters. This is apparently equivalent to putting the closed shop on the other side of the question where it may not appeal so strongly to labor unions as when it operates in their favor. It is reported that the city is paying $1.25 per hour for carpenters in violation of the ordinance which forbids the payment of more than the prevailing rate of wages. A committee has therefore been appointed by the Master Builders' Association to protest against this over-payment, and if it is not discontinued, to take legal measures to compel it to be stopped.

Lack of Transportation Stops Work

At Cleveland a few days ago the sand and gravel interests testified before the Interstate Commerce Commission that building has been halted and thousands of men are idlle because of the lack of open-top cars.

Public utilities are threatened with disaster and industry is badly handicapped because of the transportation situation. The modification of the fuel priority order is requested and Donald Willard, president of the Baltimore & Ohio Railroad and chairman of the advisory committee of the association of railway executives, pleaded for co-operation between the railroads, the shippers and the Interstate Commerce Commission, stating that it was necessary for the priority order to be enforced for a while longer and predicting better handling of the traffic by the railroads when the labor troubles are relieved.

North Carolina to Boost Highways

There will be a meeting of the good roads advocates from all sections of North Carolina in Raleigh on August 10th, the first day of the extra session of the general assembly of the state. The purpose of the meeting was stated by Colonel T. L. Kirkpatrick, president of the Wilmington-Charlotte-Asheville Highway Association, to be to convince the members of the legislature that the citizens of the state are anxious for modern hard-surface highways throughout the state.

It is proposed to submit to the people in November a referendum for a $50,000,000 bond issue for good roads.

Additional Water Supply for Philadelphia

Philadelphia is approaching the limit of its present available supply of water, and Carlton E. Davis, chief of the bureau of water, has recently taken up the matter with Mayor Moore, and under instructions from the mayor has conferred with water works experts on the subject.

Mr. Davis is considering the supply not only for the present but for fifty years to come, and believes that it will be unnecessary to bring water from distant mountains or from point outside of city limits. In addition to the Delaware and Schuylkill rivers, it is suggested that water may be obtained from artesian wells in the southern part of the city, an advantage of which would be that it does not need filtering, while the water from the rivers is far from pure and needs thorough treatment.

English Appreciation of American Engineering

It has been common practice for engineers and engineering periodicals in this country to refer to European experience and practice in engineering matters, as more generally satisfactory, though commonly more expensive, that in this country; and there has been a more or less general inclination to assume that engineers on the other side of the Atlantic need not pay much attention to what was done in this country along such lines. Readers of English periodicals, however, must have noticed the increasing attention and respect which is given to United States practices, and it may be well for us to realize that perhaps Europeans have as much to learn from us as we have from them. In fact, this may save us from mistakes of imitation. To cite only one illustration, it has become the practice here to refer to the English refuse incinerators as being a complete success in disposing of refuse without offsense and even so as to yield a net revenue. It was, indeed, reported that this was the case a decade ago, but references are becoming more and more numerous in the English technical papers to the dissatisfaction felt with English destructors by municipal officials, and they are even suggesting that much could be learned from practice in the United States in that respect.

Looking through the June 24th issue of *Municipal Engineering and Sanitary Record,* published in London, we find American reports and experiences referred to in five different articles. One of these cites our experience with cast iron pipe in confirmation of the long life of such material, another describes at length the Cobwell process applied to sludge utilization, as well as to garbage disposal; another refers to the better heating of American houses; another to the use of trailers and tractors for collecting municipal refuse, with the suggestion that the method employed in Utica, San Antonio and other cities in this country be given a trial in England; while another refers to experience in this country with bituminous concrete pavements.

In another issue we find a description of the use of concrete pipes, reinforced to withstand an internal pressure of 80 pounds per square inch, with special reference to the pipes laid in Baltimore some years ago and to the line laid later in Seattle. Another article recommends that the English take example from the United States in designing and using more artistic lighting standards, stating—"In the States the public lamp standard, which combines beauty with utility, has been brought to a high state of perfection, with the result that instead of being an excrescence, it fits in with the architectural character and the layout of streets and open spaces, and forms an important part of a general decorative scheme."

In a paper before an engineering society the writer is quted as saying, "While Great Britain has always taken preeminent place in all matters pertaining to road administration, it must be admitted that in recent years the Americans have gone a long way ahead in the quarrying industry. In spite of the higher costs ruling in that country, broken stone of excellent quality, well screened and suitable for road work or concrete, is being sold at half the price ruling here. This increased efficiency and consequent cheaper price have been achieved by the introduction of large crushing plants. A 54 in. x 42 in. American crusher, to work in conjunction with a mechanical shovel, is at present being erected in Scotland, and it will be interesting to watch what effect it will have in the future development of the quarry industry of that country."

What is Dry Rot?

The following information concerning "dry rot" is furnished by the Forest Products Laboratory of the United States Forest Service:

The term "dry rot," the Forest Products Laboratory finds, is applied by many persons to any decay which is found in wood in a comparatively dry situation. Thus loosely used the term actually includes all decay in wood, since wood kept sufficiently wet can not decay.

In the more limited sense in which pathologists use the term, "dry rot" applies only to the work of a certain house fungus called *Merulius lachrymans.* This fungus gains its distinction from the fact that it is frequently found growing in timbers without any apparent moisture supply; in reality it does not grow without moisture and is as powerless as any other fungus to infect thoroughly dry wood. Given moist wood in which to germinate, it is able to make its way a surprisingly long distance in dry timbers, drawing the water it needs from the moist wood through a conduit system of slender, minutely-porous strands.

Wood in the typical advanced stage of dry rot is shrunken, yellow to brown in color, and filled with radial and longitudinal shrinkage cracks, roughly forming cubes. In many instances these cracks are filled with a white, felty mass, the interwoven strands of the fungus. The decayed wood is so brittle and friable that it can easly be crushed into powder.

The dry rot fungus is active in nearly every region of this country, in Canada, and in Europe. It is very destructive to factory and house timbers and to logs in storage. Coniferous or soft woods are more commonly infected by it than hard words.

Street Cleaning Without Penalty

For the first time in several years no deductions were made by the Department of Public Works from payments for street cleaning in the 6th and 9th wards of Philadelphia during the month of June. It has been so common for such deductions to be made that the director of the department wrote to the contractors congratulating them upon the good work performed. The penalties imposed on the contractors for the seven districts for the month totaled $1,837.

Recent Legal Decisions

OBLIGATION TO PAY SUBCONTRACTORS AND MATERIALMEN UNDER CONTRACT AND SURETY BOND

The contract for the construction of a septic tank and appurtenance provided that the contractor should furnish satisfactory evidence "that all claims of all persons who have been employed upon tne work, or who have furnished materials for the work under this contract and according to these specifications, have been fully settled." In an action by a subcontractor on the contractor's surety bond it was held, Northwestern Bridge & Iron Co. v. Maryland Casualty Co., Wisconsin Supreme Court, 177 N. W. 31, that "fully settled" here means paid and discharged. The court said: "If these clauses are not inserted for the benefit of laborers and materialmen why are they inserted at all? The contractor agrees to furnish the pay for all the labor and material going into the completed structure. He does not carry out his contract until he has done so. The trial court was right in holding that it was the intention of the contract to protect third parties who might furnish material or labor going into the work, by insuring payment of their claims, and that the defendant by the language of its undertaking became liable in the event of the contractor's default in that respect." Judgment for the plaintiff was therefore affirmed.

STATUTES PROTECTING LABORERS AND MATERIALMEN ON PUBLIC WORKS SHOULD BE LIBERALLY CONSTRUED

The Oregon Supreme Court holds, Clatsop County v. Fidelity & Deposit Co., 189 Pac. 207, that a statute, enacted to protect persons supplying a contractor performing a public work with labor or materials for any portion of the work provided for, should be given a liberal construction in order to carry out the legislative intention. It holds that meats used in a necessary boarding camp for laborers employed on a public highway in a sparsely settled region provided for in a contract secured by bond are within the term "labor and materials" under the statute and the person furnishing them to a subcontractor is protected by the statutory bond. The Oregon statute is practically a counterpart of the federal act of August 13, 1894, from which it was derived. The Supreme Court of the United States recently decided a similar case in the same way. Brogan v. National Surety Co., 246 U. S. 257. The typical lien laws of the states and the decisions of the courts upon them should, for the most part, be put aside in construing such acts. The following have been held by the federal courts to be protected by such bonds: Trucking from a steamer landing on an island where the work was to be done, to the particular locality of the work; coal supplied to a contractor and used to operate hoisting and pumping engines employed in the performance of a contract for the contruction of a dry dock; drawings and patterns made for the contractor constructing a steam vessel for the United States, from which to make molds and castings; towing in the delivery of materials, wharfage paid in connecton with such delivery, and the local transfer or hauling of materials; and the use of equipment in the erection of a naval training station. The Oregon court holds, City of Portland v. New England Casualty Co., 189 Pac. 211, that food for horses used in the improvement of a street is "material" within the protection of the statutory bond, although admitting that on this point there appears to be a conflict of opinion in other jurisdictions.

EXTRA WORK NOT AUTHORIZED IN WRITING AS CONTRACT REQURIED

Where the work for which a bridge contractor claimed extra compensation was either required by the contract or clearly outside the contract and was not authorized by the commissioner of bridges in writing as required by the contract in the case of extra work, the New York Appellate Division holds, Snare & Triest Co. v. City of New York, 181 N. Y. Supp. 304, that the contractor was not entitled to recover therefor on the theory that the requirement that it do such work was a breach of the contract, since, if the work was not covered by the contract, it was within the provision as to extra work.

CLAIMANTS MUST JOIN IN ONE ACTION ON BOND OF CONTRACTOR FOR PUBLIC WORKS FOR UNITED STATES

In an action of a contractor's bond for public works, under Act of Congress, August 13, 1894, c. 280, as amended by act February 24, 1905, c. 778, providing that materialmen and laborers on public works may join in one action on the contractor's bond, etc., the Circuit Court of Appeals, Third Circuit, holds, Miller v. American Bonding Co., 262 Fed. 103, that the right of action is a new one, created by statute, and is not based on a common-law right of trial by jury, and a claimant refusing to proceed to trial at the same time as the other claimants, without offering any reason to the trial court for his refusal, is barred from subsequently maintaining a separate action on the bond.

STATUTORY DUTY TO PAY PAVING CONTRACTOR

A contractor furnished the labor and materials for the paving of a village street and his work was accepted, and used by the inhabitants. The village authorities refused to pay him the balance due, because the statute authorizing the work was not strictly followed in undertaking it and levying the assessment to pay for it. The New York Appellate Division holds, Dean v. Village of Wilson, 181 N. Y. Supp. 835, that, as the village trustees refused to pay this moral obligation founded in equity and justice, the Legislature had the undoubted right by statute (Laws 1919, c. 390) to compel such payment without invading the constitutional rights of any citizen, and that mandamus was the proper remedy to compel them to comply with the express direction of that statute.

NEWS OF THE SOCIETIES

August 14-18—ENGINEERING INSTITUTE OF CANADA, CALGARY BRANCH. Meeting at Banff. F. C Emery, secretary, western professional meeting, Calgary, Canada.

Aug. 26-Sept. 3—AMERICAN PUBLIC HEALTH ASSOCIATION. San Francisco. Office of Secretary.

Sept. 7-10—NEW ENGLAND WATER WORKS ASSOCIATION Annual convention, Holyoke Mass. Secretary, Frank J. Gifford, 715 Tremont Temple, Boston, Mass.

Sept. 13-17—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual convention, San Francisco, Cal.

Sept. 13-17—SOUTTHWESTERN WATER WORKS ASSOCIATION. Annual convention, St. Charles Hotel, New Orleans, La. Secretary, E. L. Fulkerson, Waco, Texas.

Oct. 12-14—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention, St. Louis, Mo. Secretary, Charles Carroll Brown, 401 Lincoln Avenue, Valparaiso, Ill.

NATIONAL FEDERATION OF CONSTRUCTION INDUSTRIES

Members service letter No. 30 dated July 9th deals principally with credit restriction and with the railroad transportation situation.

President Trigg, referring to the reports of a recent meeting between the Federal Reserve Board and the committee on deflation appointed by the executive council of American Bankers Asociation says, in discussing the responsibility of the local banker in connection with the program to deflate credit. "The success of his efforts will be measured by the care with which he discriminates in lending so that credit when required for the production of food or other articles of necessary consumption will not be restricted, while new loans for non-essential purposes will be refused and those already made will be gradually reduced."

In the present program of deflation through credit restriction, the local banker is left largely to determine what are essential and what are non-essential requirements for credit.

The perspective of your local banker may be improved if you will discuss with him the essential character of many local construction projects and point out to him that the community is laboring under a heavy and accumulated structural shortage.

In reply to a questionaire, a telegram addressed to 51 directors of the federation and presidents of member associations requesting them to express their opinions concerning the order of the Interstate Commerce Commission providing for a 30 day priority of open top cars for coal transportation, 26 answers were received and printed, abstracted or excerpted. Portions of these answers are published, of which 8 directly or indirectly endorse the priority order and a number of others submit to it as a necessary hardship or suggest alleviating modifications.

One association president wires: *Believe remedy worse than disease. Suggest priority coal orders for public utilities and reduced allotment for others—say sixty days.*

A Director wires: *I favor vigorous protest.*

An association wires: *Our association believes that efforts should be made to curtail indiscriminate delivery of coal to unneccessary uses if it curtails shipment of building materials for necessary housing.*

A state sand and gravel producers' association wires: *Believe in drastic steps being taken immediately; injunction if necessary.*

Another association president wires: *Believe we should protest vigorously against order placing open top cars exclusively in coal transportation.*

Another Director wires: *Judgement is that construction industry should make known its position in most emphatic manner possible. I doubt, however, the wisdom of injunction proceedings.*

Another association wires: *Request that you recommend modification of order, so that portion of open top cars may be available for building materials.*

Another association wires: *While we are suffering from car shortage, we are suffering more from effects policy Federal Reserve Board.*

KENTUCKY GOOD ROADS ASSOCIATION

The general meeting, convention, and exhibit of the "Kentucky Good Roads Association, the Kentucky state road engineers, the Fiscal Courts and All Allied Good Roads Interests," was held at the Jefferson County Armory, Louisville, Ky., June 15-16-17. There was a large attendance and excellent exhibits and the delegates were abundantly entertained by automobile rides through the park and luncheon at the Kentucky Culvert Manufacturing Company's Plant, by by a band concert and special musical entertainment and picture show in connection with the road machinery exhibit, and by a supper and receptionat Fontaine Ferry Park.

Among the principal papers and addresses were, Good Roads and Their Value to the State by Harvey T. Stout, Jr., an address by C. E. Drayer, sec'y. American Association of Engineers; "Statement of Future Policies of New State Highway Commissions" by the recently elected commissioner, Ben Weille; Discussion of New State Highway Law By Senator White L. Moss, Bell County, Pineville, Ky., Hon. Jos. F. Bosworth, Middlesboro, Ky., Jos. S. Boggs, Commissioner Public Roads, State Highway Department, Frankfort, Ky.

Three Minute Talks By—R. P. Duvall, Road Engr, Franklin County, Frankfort, Ky., Roland Pyne, Road Engr, Campbell County, Newport, Ky., C. B. Arnold, Road Engr, Boyle County, Danville, Ky; Discussion By County Judges of New Road Law—Presiding—E. O. Mills, County Engr, Kenton County, Covington, Ky., Judge D. C. Wells. Daviess Co., Ownsboro, Ky., Judge M. S. Mills, Pendleton County, Falmouth, Ky., Judge A. M. Caldwell, Campbell Co., Newport, Ky., Judge J. R. Lanchester, Scott Co., Georgetown, Ky., Judge Sam'l E. Dehaven, Oldham Co, La Grange Ky.

Highway Bridges-Addresses By Walter Bruan, Consulting Engr., Columbus, Ohio., Chas D. Snead, Bridge Dept Public Roads, Frankfort, Ky.

Talks on various Road Materials By Rock Asphalt-Rodman Wiley, C. E. Kentucky Rock Asphalt Company., Concrete—C. D. Franks, Porland Cement Asociation., Tar Products—American Tar Products Co., Tar Products—Barret Company., Brick.

Some of the important exhibits displayed in the armory were additionally emphasized by 50 pages of advertising in the attractive program issued for the convention.

TEXAS ROAD BUILDERS ASSOCIATION

At the recent roadbuilders convention in Austin, the Texas Roadbuilders Association was organized with Prof. R. W. Tyler, University of Texas, President, R. V. Glenn, Ft. Worth, L. W. Kemp and G. E. M.

AMERICAN ASSOCIATION OF ENGINEERS

A long contemplated Industrial Department has formally been authorized by the Board of Directors of the Association. Steps are underway to organize this department and take up consideration of the problems of mechanical, electrical and chemical engineers and industrial work.

A. M. Cornell, chief engineer of the Pettibone & Mulliken Company of Chicago will supervise the activities of the department until such time as the duties warrant the employment of a full-time paid secretary.

Funds will be raised by setting aside $2.50 out of the entrance fee accompanying applications obtained by members in industrial work, or sent in by applicants working in industrial plants. This is the same plan used in building up Railroad Department and the Federal Department. Five men were recently recommended by the Tucson Chapter of the American Association of Engineers to act as highway commissioners of Pima County. These recommendations were made at the request of the county board of supervisors and the engineers so recomended have been appointed and placed in charge of an expenditure of nearly two million dollars on the location and two million dollars on the location and construction of new roads. The commission has already employed over sixty engineers.

TECHNICAL CLUB OF DALLAS, TEXAS

At its meeting of June 22nd, the Technical Club of Dallas voted to join the Federated American Engineering Societies.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

At the meeting held in Montreal, June 28—July 3rd, the American Institute of Chemical Engineers favorable discussed joining the Federated American Engineering Socities and referred the subjects with power to the Council.

FEDERAL HIGHWAY COUNCIL

The transportation committee of the Federal Highway Council, Charles W. Reid (formerly evecutive officer of the U. S. Council of National Defense) chairman, has formulated a general policy to assist in coordinating highway transportation with other transportation agencies, encourage highway developments and stimulate its use so as to make them of maximum service, especially in facilitating and cheapening the transportation of food, raw materials and finished products. The purpose is "To Recognize the Problem of the Road Builder, to Realize the Needs of the Road Users, To Visualize Highway Transportation Requirements. To Cooperate with Railroads, and Waterways."

In order to facilitate cooperation with chambers of commerce, commercial clubs, civic bodies and other affiliated organizations, committees are being appointed to direct the work in its more important branches. The committee on policy towards other forms of transportation will make a close study of short haul and terminal problems, including transportation surveys, the motor-truck in terminal work, and motor-truck statistics.

The committee on rural motor express will study franchises, insurance, uniform receipts and bills of lading, marketing and return loads.

Special attention will also be paid to the study of highway transportation, functions of state highway department including snow removal, traffic surveys and traffic control, and the development of a policy of cooperation with motor-truck users organization.

Cooperation in educational work with universities and schools will be directed by A. H. Blanchard, professor of highway engineering, University of Michigan.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

At the annual convention of the American Institute of Electrical Engineers at White Sulphur Springs, West Virginia, June 30th, it was resolved that the institute should join the Federated American Engineering Societies but that on account of the small attendance, action should be deferred until the August meeting of the new board who will be requested to act on the matter.

AMERICAN INSTITUTE OF MINING AND METALURGICL ENGINEERS

At the meeting of June 25, the American Institute of Metallurgical Engineers discussed the report of delegates to the organizing conference held in Washington, D. C. June 3-4 and gave favorable consideration to joining the Federated American Engineering Societies and referred to subject to the Finance Committee to report on means for meeting the requirements.

AMERICAN SOCIETY OF CIVIL ENGINEERS

The deegates of the American Society of Civil Engineers to the organizing conference of the Federated American Engineering Socities, will be presented at the annual convention Portland, Aug. 10-12.

CANADIAN SECTION OF AMERICAN WATER WORKS ASSOCIATION

The Joint Conference Committee has issued a bulletin relating to the character and purposes of the Federated American Engineering Socities, in which it says that:

"The object of this organization shall be to further the public welfare whenever technical knowledge and engineering experience are involved and to consider and act upon matters of common concern to the engineering and allied technical professions.

"The organization is to deal with what are commonly known as welfare or non-technical matters.

It is a federation of societies with whose autonomy and activities it in no way interferes. It does not create a new organization but it will succeed the present Engineering Council and will be more comprehensive as to scope and membership.

"The Federated American Engineering Societies will not in any sense be a competitor of any existing organization."

AMERICAN CONCRETE INSTITUTE

The meeting of July 16th was held at the Engineering Society Building, New York. It was addressed by W. A. Slater of the Bureau of Standards who discussed shear in reinforced concrete beams in the light of recent investigations which may lead to the possibility of new units of special interest to concrete designers.

FEDERATED AMERICAN ENGINEERING SOCIETIES

A Canadian section of the American Water Works Association having about 100 members has been formed and has elected Alexander Milne, chairman; F. H. Pitcher, vice-chairman; and H. G. Hunter, secretary-treasurer.

ENGINEERING SECTION NATIONAL SAFETY COUNCIL

Safety as an aid to production was the dominant note of the summer meeting of the Engineering Section of the National Safety Council, held in Chicago, June 24.

In opening the meeting, C. P. Tolman, chairman of the Section, emphasized three mental conditions which have a vital bearing on the prevention of accidents. The first is the widely prevalent taint of epilepsy which may cause a man to lose consciousness momentarily and put his hand into a place of danger. The second is the curious effect of habit noted by Dr. D. H. Colcord in the Scientific American for June 12: "A man operating the levers of a crane, oiling a lathe in motion, driving an automobile, or crossing a crowded thoroughfare, may at a dangerous moment continue to act as accustomed by habit, thus occupying the nervous machinery with habit-chains which present conscious control." The third is another mental twist, known to all of us, by which the fear of what would happen if a man should jump off a high building, or drive an automobile into a tree, becomes an uncontrollable impulse to do that very thing.

The dinner, at the Hotel La Salle, was held in co-operation with the Western Society of Engineers. The Chicago Safety Council, and the Illinois Manufacturers' Association, and was attended by more than 200 safety men and executives. The general topic was Production, and addresses approaching this much-discussed topic from different standpoints were given by W. G. Nicholas, president American Manganese Steel Company; George A. Hart, manager, Melrose Park Plant, National Malleable Castings Company; and Sidney J. Williams, secretary and chief engineer, National Safety Council.

PERSONALS

Holmes, J. A., has been appointed resident engineer for the construction of an $750,000 earth dam at Decatur, Ill.

Witherspoon, H. K. has been appointed to the position of project engineer of the North Carolina State Highway Commission.

McComb, B. Q. highway engineer of the U. S. Bureau of Public Roads, has resigned that position to accept the appointment of division engineer,

Gadd, R. F. has been made president of the Board of Water Commissioners of Hartford, Conn.

Haase, H. J., has been made water commissioner of Elmira, New York.

Emprie, John has been appointed resident engineer of construction on the provincial highway, Canada.

Loder, A. E., has been appointed district engineer for the U. S. Bureau of Public Works in charge of South Carolina, Georgia, Florida, Alabama, Mississippi and Tennessee with headquarters at Washington, D. C.

Neuschwander, E. P., has been appointed assistant engineer of the New York Bridge and Tunnel Commission.

Potter, Prof. A. A., has been appointed dean of engineering at Purdue University.

Russell, G. A., has been appointed engineer of Geary County, Kans.

Keith, Clark, has been appointed assistant chief engineer of the Essex Border Utilities Commission, with jurisdiction of water supply, sewerage, and park systems of several municipalities near the Detroit River.

Wilkerson, T. J., will open a consulting engineering office for steel and concrete construction at Beaver Falls, Pa.

Perring, H. G., has been apointed to a position on the city engineers staff, Baltimore.

McCarty, Joseph, has organized the Joseph McCarty Construction Company of Kaukauna, Wis., for paving and reinforced concrete work.

Ames, G. K., has opened an engineering office at Tallahassee, Florida.

Polk, M. C., has opened an engineering office in Butte County, Calif.

Bellows, O. F., has been appointed assistant engineer of the N. Y. & N. J. Bridge & Tunnel Commission.

Royall, R. E., has been appointed associate professor of highway engineering in Washington and Lee University.

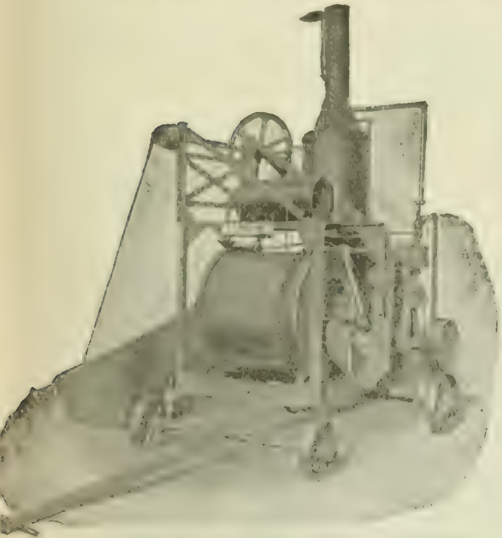
Chapman, H. D., has been appointed city engineer and superintendent of streets, Richmond, Calif.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

IMPROVED BANTAM MIXER

The use of a single large concrete mixer on a job involves high first cost, expensive transportation and installation, large driving power, costly repairs and total interruption of work when disabled. For several years the policy has been gaining ground, of substituting two or more smaller machines for one large machine. The aggregate first cost may be little or no larger than that of the single machine, the weight is less, transportation and installation much less costly and troublesome, and the equipment much more flexible. The machines can be distributed at different parts of a large piece of work and greatly facilitate the rapid placing of the concrete, one or more may be out of commission without totally stopping the work, the number used may be proportioned to the amount of product rquired at any given time, and they are particularly adapted to conditions where the concrete is required in small or separated units.



STEAM MIXER WITH POWER LOADER AND WATER TANK

These considerations and the desire to make the best and most satisfactory tool for universal operations have governed the design of the Bantam concrete mixer, manufactured by the Ransome Concrete Machinery Company.

The mixers are made in two sizes with capacities of 7 to 10 cubic feet mixed concrete per batch. The mixer, water tank and engine enclosed in a structural steel frame provided with light steel panels to completely protect it, mounted on a steel truck, weigh from 2,800 pounds to 5,150 pounds, according to size and type of engine. They are equipped with a power loader and with steam or gasoline engine as preferred, and combine rapid, thorough mixing with fast discharge for any product, no matter how dry. This is particularly advantageous for curb and gutter work, where the forms are usually stripped as quickly as possible. They are claimed to be excellent mortar mixers, for which purpose they are frequently exclusively used.

The large size, driven by a 4 h. p. engine developing at least 25 per cent excess power, is provided with a builder's hoist which has a capacity of 750 pounds on a single line at 125 feet per minute. Special attention given to improvements in the chains, rollers and door hanger hub, are claimed to eliminate about all of the troubles that can be foreseen for a machine of this class.

LAKEWOOD CONSTRUCTION PLANT

Bulletin No. 29-B of the Lakewood Engineering Company is prepared with the idea of service to road contractors and thus is of more interest and value than a mere catalog or specifications of the up-to-date plant and the equipment that it enumerates, including concrete paving machines, steam engines, portable pumping plants, locomotive unloading cranes, portable concrete mixers and a variety of standard cars, track and other standard plant.

Among the special equipment is the Lakewood concrete road finisher, a machine that spreads, tamps, and belt-finishes the road surface by power with rapidity, economy and efficiency. There is also a batch transfer attachment for the mixing machine that consists virtually of a small tilting boom derrick mounted alongside the machine on two extra wheels and operated without extra power by the weight of the descending skip so as to dump complete batches of aggregate quickly and easily into the charging skip.

The bulletin devotes several pages to the discussion and illustration of methods, plant and equipment for storing, transporting, handling and charging aggregate, cement and concrete for road construction. These are illustrated by photographs showing the charging of the concrete mixer and by diagrams giving two separate plant layouts one of which shows a single road concreting plant served by a single-track service line laid on subgrade, while the other shows two concreting plants moving in the same direction and served by rolling stock operated on a single-track line extended in both directions from the storage pile alongside the alignment of the concrete road and shifted to keep pace with the advance of the machines on the latter.

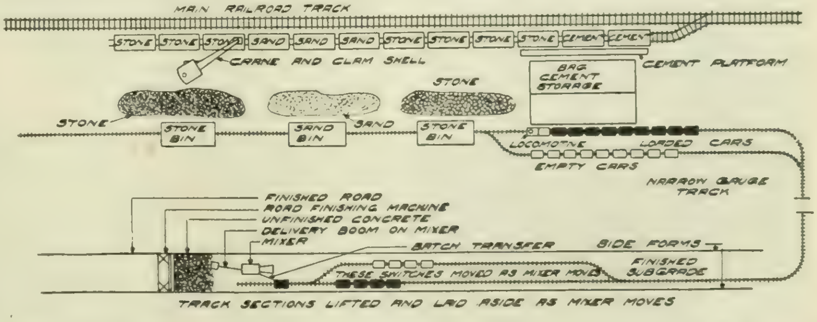
IRRIGATION SUPPLIES

The new catalog No. 11 of the R. Hardesty Manufacturing Company has descriptions, illustrations and diagrams of supplies, equipment, and plant for irrigation purposes. It is printed on 123 pages of heavy calendered paper and includes various useful formulas and tables such as the velocity of flow of water, capacity of flumes, safe loads on wooden columns and beams, the flow of water through pipes and orificies and construction blueprints, making it somewhat resemble a hand book as well as a descriptive catalog. One inset gives Kutters formula with an example and with a graphical diagram for the complete solution of the formula by inspection.

The principal items listed include automatic irrigation dams, flumes and their accessories, gates, pipes, pipe fittings, valves, radial gates, gate hoists, shear gates, hand pull lateral gates, screw lift gates, diversion gates, flume inlets and cut-off aprons and other articles. The same company issues special catalog No. 10 and catalogs of corrugated culverts, flumes, street and highway signs.

SEWER GATES

Various types of gate valves, lateral gates, canal and reservoir gates, high presure reservoir gates, diversion gates, hand wheels and stems for gates, pedestal gate lifts, loose gates, metal flumes, and the light metal measuring devices and adjustable irrigation dams primarily designed for irrigation supplies, supplied by the R. Hardesty Manufacturing Company, include a number of items conveniently available for service in sewers and sewage disposal operations.



UNLOADING, STORING, RELOADING AND DISTRIBUTING CONCRETE ROAD MATERIALS WITH TRAINS OF BATCH-BOX CARS

STANDARD GRAVITY ROLLER CONVEYORS

As the name implies, the equipment put on the market by the Standard Conveyor Company provides for the transfer of a large range of building and construction materials by the force of gravity without involving the development or application of mechanical power. It is only necessary to provide a slightly inclined pathway between the terminals and the materials or articles practically transport themselves rapidly, continuously and safely requiring only to be loaded and unloaded from the transporter.

TRANSPORTING BRICKS ON GRAVITY ROLLER CONVEYOR

The transporter consists simply of a continuous system of easily operated horizontal hollow transverse rollers in a plane inclined about 1:24, and on a straight or curved alignment. The rollers are light and rigid with anti-friction ball bearings and are made up in standard units with light frameworks 10 feet long adjustably supported on portable stable angle-iron trestles that provide a great degree of flexibility. They are made in different weights and sizes to suit different requirements. They are very easily installed and shifted and require little or no maintenance, repairs and attention. They are particularly useful for loading and unloading cars and trucks and for delivering materials.

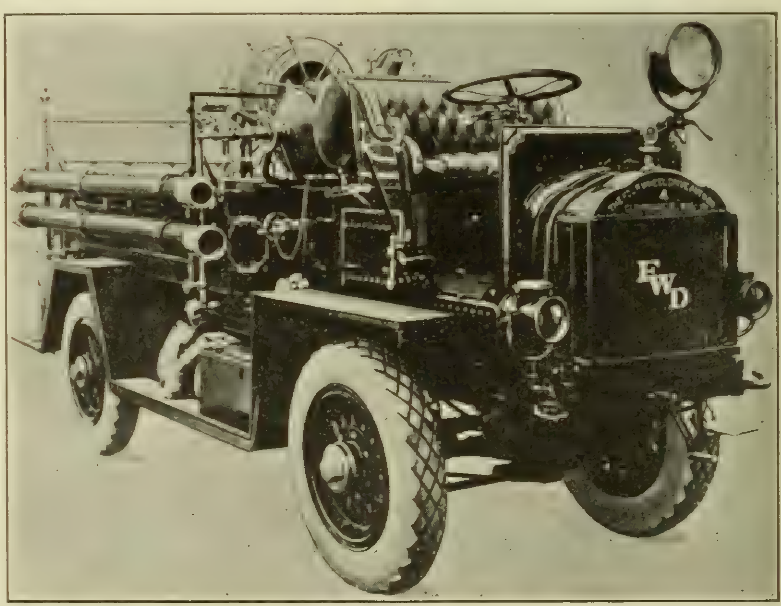
For handling bricks, the latter may be placed on them in groups supported directly on the rollers or they may be set on pallets facilitating their rapid removal in definite quantities. Pallets are also useful for handling stacks of cement to and from the storehouse or to the concrete mixer and may be conveniently connected by short light chains to facilitate their return. For handling tiles, concave cast rollers fitting the tile section are recommended. Lumber, steel rods, reinforcing bars, and many other supplies and materials can be handled by the gravity system, effecting great saving of labor and time.

GRAVITY ROLLER CONVEYOR SYSTEM WITH ADJUSTABLE TALL SUPPORTS

NEW AUTOMOBILE FIRE TRUCK

Announcement is made of the development of a new 3-ton fire truck by the Four Wheel Drive Auto Company, makers of FWD trucks. It has an unusually powerful special type J. Wisconsin motor, with a five and one-tenth inch bore and a five and one-half inch stroke, developing 42 h.p. S.A.E. The type B rotary pump, driven through a two-speed transmission, has a capacity of 500 gallons at 120 pounds pressure.

Complete modern fire-fighting equipment is mounted on the body, which is 9 feet long, 4 feet wide and 22 inches deep. A speed of twenty-five miles per hour can be attained.



THREE-TON FIRE TRUCK EQUIPPED WITH 500-GALLON ROTARY PUMP

INDUSTRIAL NOTES

HERBERT POST GREEN AND ASSOCIATES, INC.

Herbert Post Green, E. B. Black, John C. Prior, Austin W. Lord, and W. S. Manning, have opened an architectural and engineering office in New York with branch offices in Kansas City, Missouri and Columbus, Ohio.

Besides ordinary design and construction services the firm will offer special services to architects, engineers owners and contractors and will act as arbitrers between them.

TECHNICAL ADVISORY CORPORATION

Technical Advisory Corporation, with offices at 132 Nassau Street, New York City, has recently been organized to act as consulting engineers and industrial economists and advisers. The officers of the new organization are: President, Campbell Scott; vice-president and treasurer, Ernest P. Goodrich, and vice-president and secretary, William D. Ennis.

BLAW-KNOX PERSONNEL

Dewitt Clinton Grove, past vice-president of the Technical Publicity Association, has become advertising manager of the Blaw-Knox Co., of Pittsburgh, manufacturers of Blaw Buckets, Blawforms for concrete construction, Prudential Steel Buildings, Knox Water-Cooled Doors and ports, Transmission Towers, and structural and plate steel products. Mr. Grove succeeds George Land, who resigned July 1st, to enter the agency field as head of the Technical Publicity Co., of Pittsburgh.

Mr. Grove came to the Blaw-Knox Company from the H. S. Cameron Pump Co., a subsidiary of the Ingersoll-Rand Co., where he was in charge of the advertising department. Previous to that, he handled the advertising of mining machinery and other equipment for the Ingersoll-Rand Co. For eight years before this he was advertising manager of the Deihl Manufacturing Co., of Elizabethport. He was chairman of the executive committee of the Elizabeth Advertising Club.

Another new man in the Blaw-Knox advertising department is Leo Robin, a former newspaper editor of Pittsburgh, who in connection with other duties is editing "Blaw-Knox Life," the company's house organ.

PUBLIC WORKS.
CITY COUNTY STATE
A Combination of "Municipal Journal and Public Works" and "Contracting"
Vol. 49 FLORAL PARK, JULY 31, 1920 No. 5

Constructing Water Supply Works of Winnipeg*

By W. G. Chace, Chief Engineer, Greater Winnipeg Water District

Important Construction Features; Service Railroad, Diversion Dyke, Uniform Aggregate Supply· Contractors Camps, Excavating and Handling Earth, Preparation of Foundations, Concreting Invert and Arch, Manufacturing Large Pipes, Surge Tank, Tunnel and Shaft Work, Trouble from Alkali Soil.

***During the season of 1914 there were undertaken and completed the following works preparatory to the construction of the Winnipeg aqueduct: An earth filled dyke one and one-half miles long built in about fourteen feet of water for the purpose of excluding from the intake water the discharge of the swamp-fed Falcon River, whose color was very dark; a standard gauge railway with one hundred and two miles of trackage upon the right of way chosen for the aqueduct; and a telephone line of No. 14 copper wire on wooden poles.

FALCON DYKE

The Falcon River Dyke is a structure designed purely as a guiding wall to divert the flow of the Falcon River across the westerly end of Indian Bay into an adjoining body of water, Snowshoe Bay, through a canal across the neck of land separating these two bays. The material for it was obtained from a suitable deposit of sand located a few hundred feet north of the north end of the dyke. It was excavated with steam shovel and delivered by means of dinky and four-yard cars into place.

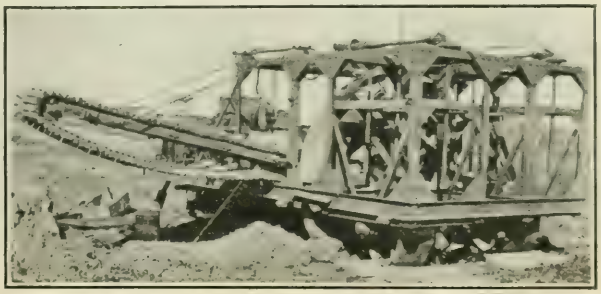
The building of a trestle was avoided by the use of a scow held out from the advancing end of the dyke with heavy stringer timbers upon which the railway track was extended; the full cars were backed up over these stringers, were dumped at the end of the dyke and the empties were run out on to the scow until the train had been discharged. This method was continued until the southerly shore was reached when the scow was removed and a slight trestle of short length permitted the closure of the dyke against the shore. The easterly exposed face of the dyke was heavily riprapped with rock from a borrow pit located at the north end of the structure. * * *

RAILWAY

No great difficulty attended the construction of a railway although most of the route was swamp covered and surface drainage was a first essential, the country being so flat. The grade was built up from side borrow entirely and for several miles this borrow consisted of nothing more solid than peat particularly on the summit of land separating Lake of the Woods from the Lake Winnipeg drainage. Gravel pits were found at convenient intervals and the work of ballasting was about eighty per cent completed at the close of the season.

The construction of this railway was *sine-qua-non* of the successful building of the aqueduct. The country traversed was virgin land between miles 40 and 96, and nearly altogether swamp covered. No highways were available for the transport of material for construction nor could any be built cheaply; railway transport was recognized immediately as the key to rapid construction of the aqueduct. * * *

BACKFILLING WITH DRAGLINE



EXCAVATING WITH ROTARY DIGGER

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*Excerpt of a paper presented to the American Water Works Association in Convention at Montreal, June 22, 1920. Accompanying paper by James H. Fuertes, consulting engineer and designer, which was published in July 3, et. seq.

WALKING DREDGE EXCAVATING TRENCH

The right of way chosen was generally three hundred feet in width from the reservoir site near Transcona at Mile 13 to Mile 74; thence to Mile 84, the Birch River forms one boundary; and thence eastward to the intake the general width chosen was 500 feet, chiefly because the maximum depth of cut necessary for the crossing of the height of land was in the neighborhood of 23 feet and the material to be excavated consisting of 7 feet of peat, 10-15 feet of sand and sandy clay to a waxy clay floor. That the accomodation afforded by so wide a right of way was warranted by the experience of construction, for numerous slides occurred, spoil from which had to be thrown in places over 150 feet away from the trench.

DISTRICT SUPPLIED CONCRETE AGGREGATE

For purposes of rapidity in construction it was early determined that the work should be let in sections of moderate lengths; this policy also encouraged the engagement of local contracting organizations but it involved that the Water District itself should operate the system of transport and should excavate and supply the sand, gravel and crushed stone for the manufacture of concrete. Gravel pits were not to be found of a satisfactory quality convenient to each eighteen or twenty mile stretch of the structure; and confusion would have been the result from any effort toward the sub-division of the responsibility either for the supply of material or for the transport of plant and material.

The Water District therefore selected after test two satisfactory sources of sand and gravel supply and throughout the major portion of the time of construction the District supplied a mixture of sand and gravel concrete aggregate upon platforms opposite the contractors' working points. The policy of supplying mixed material not only minimized the quantity of rolling stock necessary for the work but also permitted assurance of the use of a uniform material throughout the entire mileage of the aqueduct. The difficulties of inspection of concrete making and mixing were also greatly diminished thereby and the cost to the contractors for the manufacture of concrete was necessarily less than would have been the case had sand and gravel or crushed stone been supplied separately.

TESTS

In determining the quality of this uniform concrete aggregate a series of laboratory tests were carried out during the winter of 1914-15 in an effort to determine the mixture of Portland cement and of aggregate for the production of a concrete which would be water tight, sufficiently strong in compression and at the same time not wasteful of cement. These experiments were carried on with mixtures containing only one barrel of Portland cement per cubic yard.

It was ultimately determined that by the use of a proper proportion of dust or fine sand in a fairly graded sand a 6-inch wall of concrete could be made impervious to water under pressure of 80 pounds per square inch, the test adopted. (Recently investigators have been able to make 1-inch slabs impervious against similar pressure and by similar means). This subject was discussed in a paper read by the writer and Mr. D. L. McLean before the Engineering Institute of Canada in 1916.

The Water District, having determined upon the policy of supplying the sand and gravel to the contractors, determined also to supply the necessary Portland cement under purchase contracts and thereby to ensure a uniform cement for the entire project. Such a supply was obtained in Winnipeg from the mills of the Canada Cement Company and by virtue of the local sources being available the supply was kept steady and deliveries were prompt as required; storage of cement by the District was thus avoided.

TRAFFIC ON SERVICE RAILWAY

The total traffic over the District railway during the period of construction was fairly heavy, carloads of aggregate contained 23 cubic yards each or a total weight of 130,000 pounds per unit; the rate of consumption of concrete materials ran as high as 1,200 cubic yards per day and the principal source of supply was located at Mile 31.

Throughout the entire construction approxi-

DRAGLINE USED FOR ROUGH-TRIMMING TRENCH

BACKFILLING OVER COMPLETED CONDIT

mately 1,000,000 cubic yards of sand and gravel were moved for concrete manufacture; for the building up of trench foundation where firm soil was at too low an elevation; and for backfill where native and local materials were scarce. This traffic was in addition to the haulage of Portland cement — about 600,000 barrels — the distribution of contractor's plant and reinforcing steel for the transport of passengers. A tri-weekly mixed train served to distribute plant, cement and steel, and meet the requirements of passenger movement; aditional trains handled the sand and gravel.

INTAKE

The site chosen for the intake is a rock cut on the Peninsula which forms the north end of the Falcon dyke. Gathering walls of rock fill over a sand core extended about 200 feet into the lake to permit the draught of water from a sufficient depth. A concrete chamber located in the rock cut, houses the trash racks, the screens, the sluice gates and stop logs which provide the control of water discharged into the aqueduct; this building was covered with earth to lines coinciding with the profile of the peninsula.

During construction, a cofferdam of sand across the opening between the gathering walls provided the shelter for the rock excavations. This type of cofferdam, easily protected, easily maintained and easily removed, was quite satisfactory. * * *

CONTRACTORS' CAMPS

Speaking generally each contractor endeavored to keep his work concentrated at each camp and, excepting for backfilling operations, the excavation, trench trimmings and aqueduct building were confined within a distance of one-half mile in each case. The number of camps per contract varied from two to five depending upon the possible rates of construction; the total number of camps during the successive years were: 1915, eleven camps; 1916, fourteen camps; 1917, twenty camps; 1918, twenty-two camps; besides those operated at the District's sources of material supply, three in number. The maximum number of men engaged upon the project was about 2,500.

EARTH HANDLING

The methods of handling earth varied considerably; on the easterly 47 miles, Bucyrus draglines of from ⅝ to 3½ cubic yards capacity were used for excavating and for backfilling. These draglines were especially designed to be self propelling and were supported upon the swamp surface by means of timber pads built in sections, the machine itself being mounted upon rollers.

PLACING FOUNDATION FILL

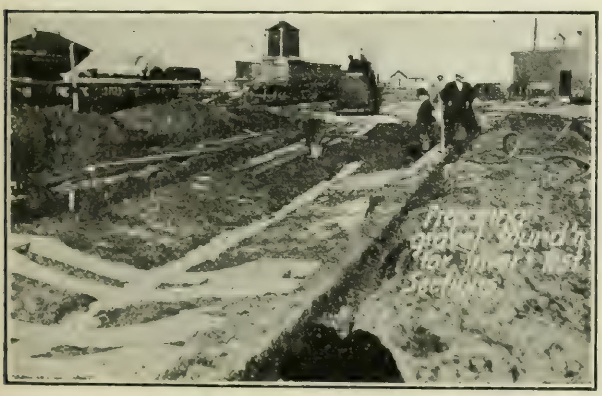
Between Miles 31 and 51 a few steam shovels were used with greater or less success; these were supplemented by means of draglines. Between Miles 13 and 31 walking dredges were used; here the cut was generally shallow and the soil fairly firm. Each type of machine had its advantages but speaking generally the dragline seemed the most suitable device.

Throughout the easterly 47 miles the spoil of excavation was dumped close to the trench and was formed into an elevated grade for a dinky railway track used to distribute the mixed concrete; earth so placed was convenient for backfilling but was occasionally the cause of slips of the trench wall, in which event the tramway grade was maintained by means of pole trestles.

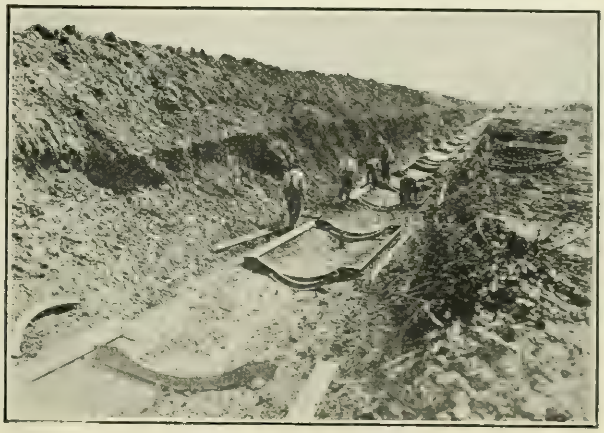
Payment for the work of excavation was limited to fixed slopes of the trench walls namely one horizontal on three vertical in firm soil, and one horizontal on one vertical in soil which would not stand on steep slopes. Machine excavation was permitted to within 6 inches of the determined floor grade, and it was required that the remainder of the earth should be removed by hand.

DRAINING AND PUMPING

As all of the trench grade lay below the ground water level the problem of handling ground water



PREPARING GRAVEL FOUNDATION FOR INVERT TEST SECTIONS



TRENCH TRIMMING FOR PIONEER PADS

seepage and trench floor seepage was constantly a prominent one. Notwithstanding this fact it was possible to obtain compliance with the requirements of the specifications that all concrete must be laid in the dry.

This was accomplished by means of a system of side wall trench drains and of a center line depressed drain lined with a wooden box with transverse cover slats and surrounded with coarse gravel or broken stone. Diaphragm pumps operated by gasoline were successful in maintaining the ground water below the grade of the trench floor. Trimming of the surface of the earth for the reception of concrete was not permitted until the hour of concrete placing, and by observance of this rule the preservation of a firm surface for the receipt of concrete was assured.

(To be Continued)

Higher Water Pressure for St. Paul

In order to increase the water pressure in the down-town section of St. Paul, J. W. Kelsey, superintendent of the water department, has prepared plans for a new 6,000,000-gallon reservoir to be built adjacent to the McCarron pumping station and carried about 50 feet higher than the present reservoir. This was the result of a petition from the business men for greater pressure, they stating that at present water cannot rise higher than the third floor of some of the buildings.

The Water Works of De Land, Florida

Chief among the advantages which the citizens of De Land, Fla., claim for their city is a supply of artesian water unlimited in quantity and of exceptional purity. As to the quality, the Board of Awards of the St. Louis World's Fair gave a medal to the water from the sister town of Orange City, as the world's finest water, and De Land's water has the same origin. The state chemist has made the following analyses of the De Land water.

Color	none
Sediment	none
Turbidity	none
Odor, cold	none
Odor, hot	none
Reaction to litmus paper	slightly alkaline
Total solids by evaporation	170.00 p. p. m.
Loss on ignition	1.940 p. p. m.
Fixed residue	168.060
Free ammonia	.006
Albuminoid ammonia	.042
Chlorine	11.120
Nitrogen as nitrates	.080
Nitrates	none

GROUNDS OF DE LAND WATER WORKS

The water works are in charge of city engineer George Hill, who has been identified with every engineering project in and near De Land. He operated the first locomotive over a short road between De Land and the St. Johns river, later was chief mechanical engineer of the largest saw and planing mill in this section of the state, and has been in charge of the water works since 1909.

The water works was installed in 1890, its first equipment consisting of a 30 horsepower boiler, a small pump, stand pipe and one of the present wells. The population then was slightly under 1500. Today the population is over 5000 and the equipment comprises a 50 horsepower Ames boiler, a 50 horsepower Casey and Hedges boiler, one 10-inch well 270 feet deep and one 6-inch well 400 feet deep, each operated by a duplex steam pump, and a standpipe of 47,000 gallons capacity on a reinforced concrete trestle 100 feet high. The plant has a capacity of 2¼ million gallons per day. Wood is the principal fuel used under the boilers and a reserve stock ample for 30 days is always held in reserve. There are about 1000 taps in service and about 43 applications for buildings under construction. Ninety-five per cent of the water used passes

DE LAND PUMPING STATION AND TANK

through meters. There are 65 hydrants for fire protection and street use and 26 miles of mains from 10 inches in diameter down.

The minimum rate is $1 per quarter, with an excess rate of 15 cents per thousand gallons for all over 10,000 gallons; the only exception from this being a flat rate of 15 cents per thousand gallons for florists and truck gardeners. During the past three years, the cost of operation has averaged $6,500 annually, while during the same period the gross income has averaged about $12,000, leaving a net income of $5,500. Surrounding the plant is a small park where abundance of flowers and semi-tropical shrubbery and careful attention to the neatness of the entire property make it an attractive spot.

Building a N. J. State Highway of Concrete

Four and one-half miles of 18-foot concrete highway at Pompton Plains well equipped with sand, gravel and stone producing facilities and well selected construction plant insuring first-class results.

Section 1 of route 8 of the New Jersey Highway Department consists of about 4½ miles of concrete roadway 18 feet wide, 6 inches thick at the edges and 8½ inches thick at the crown, and having on each side a shoulder surfaced with 3-inches of bituminous macadam 3 feet wide, adjacent to which is a French drain 8 inches wide on top with an open-joint pipe laid in the bottom and covered with broken stone.

The road has a nearly straight alignment with maximum grades of 1 per cent and is located on the line of an old macadam road 24 feet wide. The new grade varies somewhat from the old, being in most cases above the latter, and requiring about 1,000 yards of excavation and 9,000 yards of fill derived from the contract excavation and from the sand pit.

The construction involves about 20,000 linear feet of French drain, 3,000 feet of 12, 15 and 18-inch agricultural tile drain-pipe, four drainage ditches with an aggregate length of 3,500 feet, 2,000 linear feet of wood hand rail, 100 linear feet of pipe rail, 5 brick manholes, and about 12,000 cubic yards of 1:2:3 concrete foundation made with Penn Allen cement and ¾-inch and 1½-inch trap-rock, and 16,000 spuare yards of 6-inch asphaltic macadam surface The contract was awarded, on a unit cost basis, to the firm of Harrop & Shannon for about $200,000.

SAND PIT

The road passes through the village of Pompton Plains, which is about midway between the extremities of this contract section. The contractor's headquarters are established there in charge of James R. Donnelly. A few hundred feet from his office, the contractor has opened a sand and gravel pit where a ½-yard Keystone shovel has stripped off the loam from a 300 x 500-foot area to a depth of from 5 to 8 feet, and another shovel of the same make and size is digging, for the screening plant, sand and gravel from a cut about 25 feet wide and 10 feet deep that extends across the full length of the sand pit.

The sand excavation shovel delivers to three 1-yard side-dump cars hauled over 24-inch gage industrial track and dumped into the depressed hopper of a bucket elevator, which raises the materials about 30-feet to the set of three cylinder screens. These discharge into overhead storage bins of about 150 yards capacity which are divided into three compartments for sand, coarse gravel and fine gravel respectivly.

The horizontal floor of the bin is pierced with three holes commanded by sliding steel gates 10 feet above the roadway, by levers that provide for the discharge of sand and gravel into 5-yard automobile trucks spotted on the service road under the bin. The screening and elevating plant

AGGREGATE AND CEMENT STORED ON SUB GRADE

TAMPING MACHINE FINISHING ROAD SURFACE

STEAM SHOVEL EXCAVATING IN SAND PIT

is opperated by a Corliss 20 h.p. steam engine, and has a capacity of 150 yards per day.

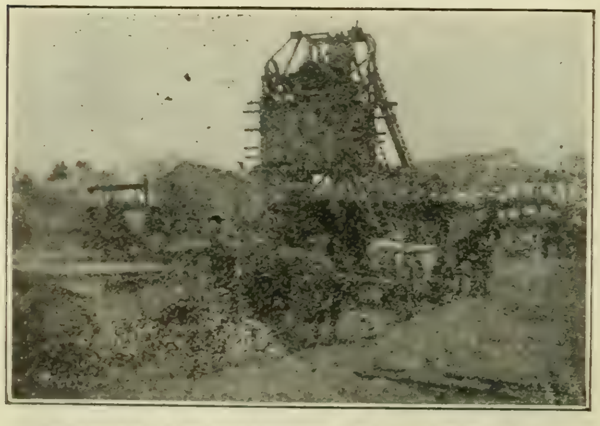
The capacity of the excavating shovel is nearly twice as much as that of the screening plant and part of its product is delivered directly, without screening, to automobile trucks that enter and leave the sand pit on a plank incline and deliver the unscreened sand to purchasers who use it for fill and to the contractor's own trucks for use as fill on the low part of the contract. Four trucks of 4 and 5 yards capacity haul the fill a maximum distance of two miles, making a round trip in about 40 minutes.

SONE QUARRY AND CRUSHER PLANT

Trap-rock for concrete is produced at the rate of a little more than 100 yards per day in a quarry leased, opened and equipped by the contractor on a hillside about 4½ miles from the most remote point of the contract and operated on sub-contract by an independent superintendent.

This quarry has a nearly vertical face about 40 feet high and 100 feet long, requires little stripping and furnishes satisfactory materials which break into small-size stones without much block drilling or sledging. Usually the ledge is shattered by drilling two tiers of holes about 20 feet deep and 8 feet apart in both directions. The holes are drilled by a Wood impact drill, operated by steam, and each vertical hole is charged with cartridges of 60 per cent dynamite.

The shattered stone is loaded by hand into dump cars on industrial tracks and pulled by teams a maximum distance of 150 feet to the 12x24-inch Reliance jaw crusher, the product of which is handled in a standard screening and storage plant having overhead bins with about 100 yards capacity provided with five bottom gates through which the stone is delivered to trucks. The average product of the quarry is about 20 yards of screenings, 15 yards of ¾ inch, 50 yards of 1½-inch and 40 yards of 2-inch stone in one 9-hour shift. The 2-inch stone is rejected from the screens and is recrushed in a Farrell crusher which is operated about half the time and delivers to a smaller portable bin, with a capacity of 40 yards storage and four side spouts for loading trucks. The stone crushers are operated by a 10x12 inch Farquhar engine with a 50-h.p. steam boiler, which also supplies steam for the rock drill.



CRUSHING AND SCREENING PLANT AT QUARRY

CONTRACTORS YARD

Adjacent to the sand pit, the general equipment and storage yard for the work has been established, with a 200-foot railroad track siding one end of which is occupied by a 14x75-foot cement storage shed with a capacity of about 5 carloads or 1500 barrels. There is a 12x24-foot tool shed, an 8x12-foot gasoline shed (in which there are generally maintained ten 60-gallon tanks), an 8x12-foot oil house containing five 60-gallon tanks and various small barrels and tanks for kerosene, lubricating oils, etc. There is a 10x10-foot smith shop, several small sheds and a 20x20-foot mess and bunk tent.

There is also a 10x12-foot empty bag storage shed in charge of a man who is constantly employed in gathering up bags, shaking and folding an average amount, when the work is in full progress, of 900 bags a day which, at the present price of 25c each, makes an important item of saving and allowing for losses should amount to over $30,000 for the 125,000 bags required on the contract. It has been found necessary to pay particular attention to this point because, without it, large numbers of bags are lost, stolen or destroyed.

Besides the trucks employed in handling the materials, there is a 1½-ton Republic utility truck with a detachable cover used for general service and for bringing the men back and forth from their work. The superintendent also has a five-passenger touring car in constant service.

CONSTRUCTION OPERATIONS

Where there is no excavation, the surface of the road is loosened by rooter plows (of which there are three) drawn by one of the two 10-ton Buffalo rollers. The fill, if any, is deposited on the prepared surface and rolled to grade with an accurancy of about ½ inch.

Abundance of broken stone and sand delivered by the automobile trucks are always deposited on the subgrade in advance of the concreting, sufficient for at least two days supply. Considerable difficulty has however been experienced in securing cement, the lack of which has frequently caused the concreting to be shut down entirely for several days at a time.

FINISHING CONCRETE ROAD IN REAR OF PAVER

At the site the cement is stored in lots of 200 bags which are piled solidly on 20-inch x 22-foot platforms made of a pair of 2-inch planks cleated together and covered with heavy tar paper. With each platform there is provided one 18x30-foot or one 15x25-foot tarpaulin to protect the cement bags from rain.

A large number of Blaw steel forms are provided and are kept set for about 200 feet in the rear of the concreting machine and for about 900 feet in advance of it.

The concrete is mixed in a 1-yard Koehring machine supplied by 11 wheelbarrow men. The concrete is laid in sections 12 to 15 feet long, with expansion joints 75 feet apart, at an average rate of 300 linear feet in one 9-hour shift, a speed which it is expected will be increased if a sufficient supply of cement can be maintained in advance.

After the concrete has been placed it is finished by a Lakewood machine operated about one-half the time. In special places, however, wherever the consistency of the concrete requires it, the road surface is additionally finished by working with a long-handled two-section hand roller.

Water for the concrete mixer and for saturating the hay with which the fresh concrete surface is kept covered for several days after its completion, is delivered along the full length of the line through a special pressure pipe installed by the contractor, which is supplied from a very large spring a mile from the roadway, where there is located a 2x3x3-inch Cameron steam pump which maintains a pressure of about 80 pounds in the 2½-inch pipe line which is reduced to 2 inches at the further end. The line is run in both directions and pieces are taken off at one end and put on at the other as the work advances.

FRESH CONCRETE COVERED WITH WET HAY

In order to protect the fresh concrete from rain, there are provided enough 12x18-foot covers to suffice for one day's run and these, being kept always a short distance in the rear of the concrete machine, can be almost instantly put in place on the approach of a storm or when the work is left at night. Each frame is a skeleton roof about 24 inches high in the center and with a pitch of 10 inches from the longitudinal line in both directions. It is covered with chicken wire on which there is a layer of the best tar paper. Each frame can be quickly and easily handled by four men and their use gives security against any damage by violent showers.

The full mixer gang requires about 30 men and the maximum force employed on the entire contract at one time is 75 men, who receive as high as $7 each per day for common labor.

All of the contract work is now completed except the concrete which, having been delayed by lack of cement and by backwardness in securing right of way, was only about 75 per cent completed on July 1st.

Large-Scale Gravity Storing and Handling for Road Materials

The W. Z. Williams Company, Macon, Ga., is now building 6½ miles of concrete highway in Bibb County, Georgia, with an equipment carefully designed to reduce to almost nothing the labor of handling the concrete materials.

Cement, broken stone and sand are delivered by the railroads to a spur of the Macon and Birmingham Railroad that crosses at right angles the high way under construction near its center point. The spur is run over a long trestle built of timber and containing, under the standard-gage track, a 4,000-ton storage bin 540 feet long into which the standard-gage 12-yard dump cars and gondolas in which the aggregate is received are dumped, as hauled by the locamotives.

Close to the trestle and adjacent to another spur of the railroad is a cement storage house about 250 feet long.

A 24-inch-gage service track runs under the trestle bin from end to end, passes close to and parallel with the cement house and is continued a short distance to the highway, where it branches in both directions and is extended to the ends of the construction work. On this service track there are installed 42 Western roadbuilders' trucks, each equipped with two Western steel batch boxes of 1-yard capacity. The trains of cars and batch boxes are run under the storage bin, from which they are filled by gravity, cement bags are emptied into them from the loading platform at a lower level as they pass the cement house, and they are hauled by three Whitcomb gasoline geared locomotives to the mixer, where the batch boxes are unloaded as required by a standard crane attachment, which dumps the contents into the mixer skip.

Each gasoline locomotive hauls a train of 10 to 13 cars of concrete materials to the mixer, and the use of the batch boxes and car delivery is estimated to save the labor of 20 wheelbarrow men at the mixing machine.

Besides the equipment enumerated, there is a four-bag Koehring mixer, a Lakewood concrete road paver, a Lakewood subgrader, an Austin "Giant" road grader, a Kelly-Springfield road roller, a Western service car, Blaw-Knox steel forms and the usual equipment of wheel and drag scrapers and plows.

The contractors were fortunate in being able to locate a site with topography favorable to the installation of this plant, and in being able to build the storage bin so that most of the material could be salvaged after the competion of the job, and so that the bin planks could be sawed in a local mill already installed in the vicinity by the contractor.

Limiting Motor Truck Loads

No class of pavement has yet been suggested as practicable which can withstand the heaviest loads which truck manufacturers can construct their vehicles to carry. Even the toughest granite block pavement would rapidly wear away were a railroad locomotive to pass frequently over it, while most of the soils available for highway foundations would yield under such enormous weights even though covered by the thickest practicable foundation. It seems to be generally admitted, therefore, even by the manufacturers of trucks, that it is necessary to place some limit on truck weight in order to prevent the rapid destruction of the roads.

Discussing this subject, R. E. Fulton, vice-president of the International Motor Company, has stated recently that "It is but equitable that those vehicles which cause the greatest amount of damage to the roads should be restricted in their use at the present time, and that in the future they should contribute the largest share toward road repair costs." He cautions, however, against reducing the maximum load to too low a limit, using the following figures in support of his belief. He states that 300,000,000 tons of material were shipped by truck in 1919. If this had been carried by one-ton trucks it would have meant 900,000,000 tons passing over the road, 600,000,000 of it being the weight of the trucks. A 7½-ton truck, however, weighs somewhat less than 7½ tons itself, and consequently if the 300,000,000 tons had been carried in 7½-ton trucks, the roads would have had to bear only 600,000,000 tons of traffic.

The amount of material which must of necessity be carried by trucks is increasing rapidly, partly because of the lack of railroad transportation facilities. If a given amount of such material must be carried by 2½-ton trucks instead of 7½-ton trucks, it will mean three times as many vehicles and probably double the burden on the roads. This will mean increased road wear as well as increased cost of transportation.

The light-weight truck has the advantage over the heavier one of greater speed, and must utilize this advantage to minimize the cost of transportation. This increased speed however, produces road wear in excess of that caused by the heavy truck, although carrying a much less load.

Another point introduced by Mr. Fulton is that of impact. He states that the tests of the United States Bureau of Public Roads show that the road impact is the real cause of road wear and that the "unsprung weight" is the controlling factor in road impact, unsprung weight being that part of a truck's total weight which hits the road a direct blow undiminished by springs. For this season a chain-drive truck, in which all of the driving mechanism is carried on the frame above the springs, has less unsprung weight than a shaft-driven truck, in which the entire weight of the final drive and its housing rides directly on the rear axle below the springs.

"The tests at Washington showed that a 5½-ton chain driven truck produced only 68 per cent of the road impact delivered by a 3-ton shaft driven truck, although the larger truck naturally carried a heavier load."

Effect of Storage on Cement

Results of twenty-five hundred tests show deterioration of strength under all conditions and lengthening of time of setting.

Researches in the properties of concrete and concrete materials at the Structural Materials Research Laboratory are being carried out through the cooperation of the Lewis Institute and the Portland Cement Association, Chicago. At the April meeting of that association, Duff A. Abrams submitted a report on certain tests of the effect of storage of portland cement in different kinds of packages and under different conditions on its concrete and mortar-making properties. The following is a summary of that report:

Tests were made on three different lots of portland cement, which had been in storage for periods up to two years. The cements were stored (A) in the laboratory; (B) in the basement of the building; and (C) in a shed in the yard. In general the cement was stored in lots of 800 to 1,200 pounds, in standard cloth sacks; in one group of tests two brands of paper sacks were also used. In another group the cloth sack containers were covered with thin layers of (1) portland cement and (2) hydrated lime. Tests were made at ages of 7 and 28 days, 3 months, 1 and 2 years, on samples taken immediately upon receipt from the dealers' warehouses and after storage for 3 and 6 months, 1 and 2 years.

This report includes compression tests of about 1,000 6x12-inch concrete cylinders, about 1,000 2x4 inch cylinders of 1-3 standard sand mortar, and about 500 miscellaneous tests. Tests have been under way for 3½ years; some of the later tests are incomplete as this report is written.

The following are the principal conclusions from this investigation:

(1) There was no essential discrepancy between the indications of the compression tests of 1:5 concrete in the form of 6x12-inch cylinders and the tests on 1:3 standard Ottawa sand mortar in 2x4-inch cylinders.

(2) Compression tests of concrete and mortar showed a deterioration in strength with storage of cement for all samples, for all conditions and periods of storage and at all test ages. The deterioration was greatest for the samples stored in the shed in yard, and least for the samples stored in the laboratory. The basement storage was nearly as severe as outdoor.. The deterioration was greater during the first 3 months than for later 3-month periods. A greater deterioration was found in the tests made at the age of 7 days than at 28 days and later test ages.

(3) After 3 month storage in shed in yard the cement had 80 per cent of its original strength; after 6-month storage, 71 per cent; after 1-year, 61 per cent; after 2-year, 40 per cent. The deterioration was probably greater in these tests than would be found in a larger lot of cement stored under similar conditions.

(4) The effect of storage of cement on the concrete or mortar strength is largely a question of the age at which concrete or mortar is tested. The average strength of cement stored in shed in yard when tested at 7 days (for all periods of storage) is 64 per cent of the strength when received from the warehouse; at 28 days, 71 per cent; at 6 months, 78 per cent; at 1 year, 82 per cent, and at 2 years, 85 per cent. A somewhat similar relation is found for other storage conditions. It is a matter of the utmost importance to note that the strength of concrete is not permanently reduced to the low values found in the 7 and 28-day tests.

(5) For periods up to 1½ years there was no marked difference in the quality of cement stored in cloth and in paper sacks. The two brands of paper sacks gave almost identical results.

(6) Only a slight advantage was found from the protection of cement in cloth sacks which were covered by thin layers of Portland cement or hydrated lime. The results obtained do not justify the cost of this method of protecting cement stored in sacks.

(7) The most favorable storage condition (in laboratory) and the least favorable (in basement and shed) gave strengths of the same order of magnitude; indicating that the possibilities of improving the storage condition of cement in sacks in this climate is rather limited. The storage period and the age of the concrete or mortar at test are of greater importance than the exact condition of the storage, so long as the cement is protected from direct contact with moisture.

(8) Storage of cement prolongs the time of initial and final setting.

(10) The normal consistency was only slightly affected by storage.

(12) The deterioration of cement in storage appears to be due to absorption of atmospheric moisture, causing a partial hydration which exhibits itself in reducing the early strength of the concrete and prolonging the time of setting.

Only a negligible quantity of lumps were formed up to 1 year storage. The lumps found in the sacks after storage for more than 1 year presents a puzzling feature of such tests; they were generally discarded before testing the cement. Tests on concrete using only broken lumps as cement gave considerable strength.

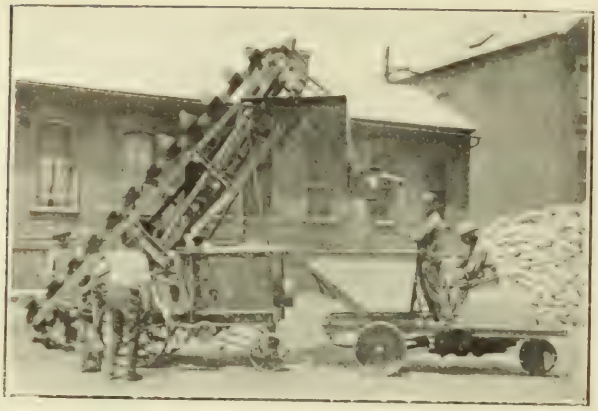
This series of tests did not include bulk storage of cement, however, there is reason to believe that cement may be stored in bulk for long periods without materially affecting its concrete and mortar-making qualities.

Machinery in Alley Paving

Force of a contractor in Chicago reduced one-third and output increased one-fourth after introduction of full mechanical equipment.

The Schmidt Construction Company of Chicago, in constructing concrete pavement in alleys in that city, is using a very complete equipment of machinery and has thus reduced the average number of men employed from 32 to 20. Moreover, where formerly their maximum daily output was 600 square yards, the average since using the full mechanical equipment is about 750 square yards.

LOADING SAND INTO TRUCTRACTOR

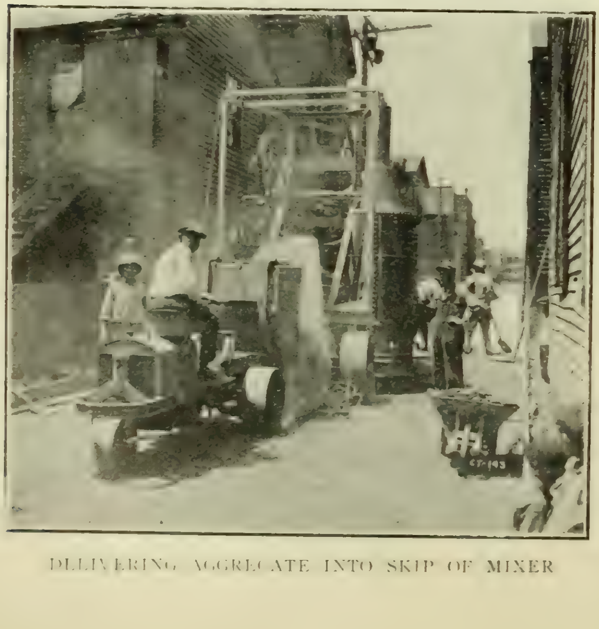


LOADING SAND FROM PILE TO TRUCK

The alley paving work is scattered about in different part of the city, making it necessary to move the machinery from job to job every few days. Consequently, portability of the machinery is an important consideration.

The average width of alleys being paved is 15 feet 4 in. The specifications call for concrete mixed 1:2:3 and laid 7 inches thick. The average alley job consists of about 1,000 square yards of pavement. In carrying on the work the contractor uses a Jeffery automatic loader, a Barber-Greene loader, a Koehring mixer and three gasoline propelled Clark "tructractors."

The Jeffrey loader is located at the sand storage pile and the Barber-Greene loader at the stone storage pile. Each of these is provided with a measuring hopper into which the buckets of the loader discharge. The tructractor runs under the hopper mouth of the loader and receives from one 6 cubic feet of sand, and from the other 9 cubic feet of stone, and three bags of cement are added to them by hand by laborers. The dry materials are then hauled by the tructractors and dumped directly into the skip of the concrete mixer. The round trip haul from mixer to the two loaders and return is 1,000 feet, and is made in three minutes; therefore with three tructractors a batch a minute can be delivered to the mixer. The average day's output of 750 square yards is equivalent to about 146 cubic yards, or 18 cubic yards per hour. As a batch is a little less than one-half a yard, the outfit is apparently turning out about 40 batches an hour or a little better. This is certainly a good record for an average daily performance.



DELIVERING AGGREGATE INTO SKIP OF MIXER

The number of men employed on the work comprises one engineer and two laborers for each of the two loaders, two laborers loading cement, three men operating the tructractors, and nine men at the mixer, these last consisting of four laborers on the wet side, two laborers on the dry side, two mechanics and one fireman. This gives a total of twelve laborers and eight skilled men.

Operation of Sewage Treatment Plants

Studies of large plants of all types being made by the U. S. Public Health Service, with special attention to the sludge problem.

We have stated repeatedly, and unfortunately it still remains true, that although some of the best engineering talent of the country is used in designing sewage treatment plants, and millions are spent every year in constructing them, in a great majority of all but the largest plants the operation and upkeep are given little thought and it becomes a matter of apparent indifference whether or not the plants function as they were intended or produce the results which it was their purpose to attain. We would not even dispute the claims made by some authorities that not more than one per cent of the sewage treatment plants of the country are giving even approximately as good results as they should.

Even those plants which are operated with a fair degree of success do not often furnish for the profession the exact data which are necessary for a thorough study of the operating features of sewage treatment, and this also is of considerable importance to the development of the art.

Chiefly to collect and compare operating data and results, the United States Public Health Service has begun a survey of some of the larger sewage treatment plants of the country, these including the plants at Canton and Alliance, where there is tank treatment followed by contact beds; at Rochester, where there are screens and tanks, and also tanks and filters; at Columbus, Fitchburg, Baltimore, Reading, Atlanta and Lexington, where there are tanks and filters; at Dallas where there are tanks; and at Houston where there is activated sludge. It is possible also that the activated sludge plant at San Marcos, Texas, will be studied.

Through the courtesy of H. B. Hommon, associate sanitary engineer of the Service, under whose charge the investigation is being made, we are able to give an outline of the plans of the Service.

It is proposed that an engineer and chemist visit each plant, the engineer first collecting the data and the chemist remaining at the plant for about two weeks making analyses and recording results. The form sheets for recording the data have been prepared and seem to cover all possible information which could aid in the study of the plant. The main divisions of the data are classified under the heads of the sewerage system, sewage pumping, data concerning sewage at entrance to treatment plant, description of the sewage treatment plant (this being subdivided into sewer outlet, grit chambers, fine screens, sedimentation tanks, chemical precipitation, sludge production, activated sludge and filters) ultimate disposal of sewage, cost data, and general information. The chemical analyses provide for determination of settleable solids, suspended solids, oxygen consumed, alkalinity, chlorine, nitrites and nitrates, relative stability, fats in raw sewage; also analyses of the sludge, including specific gravity, per cent moisture, volatile matter, nitrogen, fats, alkalinity or acidity, and free CO_2.

It is apparent from the inclusiveness of these data that it is the aim of the investigators to obtain information about everything pertaining to the installation and operation of the sewage treatment plants. Says Mr. Hommon: "We are laying special emphasis on what the men in charge of the various plants think is the cause of foaming in Imhoff tanks and what their remedy is for stopping it. We are also laying stress on what farmers and vegetable growers think of sewage sludge as a fertilizer, how they haul it and how far, and what method is used for distributing it over the land; also what vegetables or other farm crops are most benefited by the use of sludge, and further, how the farmers compare sewage sludge with manure. Our engineer goes among the farmers and gets their personal opinions and takes pictures of growing crops. This part of our survey has become very interesting and I was surprised to learn how well the farmers think of sludge as a fertilizer and to see what little attempt has been made to encourage the farmers to use it, that is, by way of placing the sludge convenient for loading and hauling. As manure becomes scarce in our large cities, some cheap fertilizer must be found to take its place and I believe sewage sludge is the nearest substitute and it may be a better one. I expect to collect a lot of valuable data on this subject.

"We are collecting data on the filtering material used in filters. This pertains particularly to deterioration. We are opening the beds to examine the media and incidentally we are reporting on clogging, worm and bug life and anything that is unusual.

"Our engineer is also endeavoring to learn whether there is any deterioration of concrete due to some constituent of the sewage.

"We are also getting data on the cost of operating treatment plants and an itemized account of the skilled and unskilled labor employed. We are dividing this to show amount paid for actual operation and for upkeep of grounds.

"The questions of deep and shallow Imhoff tanks and the depths of sprinkling filters are also under consideration and we are trying to get an expression of opinion regarding these subjects from those who are actually in charge of the plants.

"Our men, without revealing their identity, are interviewing residents in the neighborhood of the treatment plants to learn how far odors extend from the plants.

"The chemist is analyzing 24-hour, hourly composite samples of the raw waste, and effluents of tank and filters over a period of two weeks. In addition, he is collecting the chemical data obtained at each plant during the previous year.

"We are making a special attempt to get analyses of the fats in the composite raw sewage and in the sewage reaching the plant following the three meals of the day. It has always occurred to me that if fats from sewage were ever to be recovered in a practical way they would have to be collected from the sewage following meals. Our chemist is also determining the fats in the sewage sludge, along with the nitrogen and other fertilizing ingredients.

"The chemist is also endeavoring to learn something about the composition of sludge that will show whether a tank is working properly. He is determining the reaction of the sludge filtrate to show whether the water in the sludge is acid or alkaline and to what extent. He is also determining the specific gravity and per cent moisture of the sludge.

"The settleable solids in all the samples are being obtained and the settleable solids by weight in the raw sewage.

"In connection with the chemical work, it is proposed to endeavor to establish uniform methods of making analyses and standard forms for reporting results, this applying particularly to plants where only a small amount of chemical work is being done and where comparatively inexperienced men are in charge of the plants."

Briefly stated, the purpose of this survey is:

1. To obtain first-hand information regarding the results that are being obtained in the treatment plants of this country, to be used in answering inquiries from cities and towns which are contemplating the installation of treatment plants and want information regarding the plants in operation.
2. To secure accurate information by the same engineer and chemists from the various plants and report it in such manner that engineers can draw conclusions regarding the comparative merits of the various devices used in sewage treatment plants.
3. To collect data regarding the use of sludge as a fertilizer, with especial emphasis on securing evidence from the farmers and gardeners. The purpose of this is to show how far sludge is being utilized and suggest how its use can be encouraged.
4. To prepare a report which will include a

complete description of the plants, including reasons for installation and relief obtained, and giving a general plan of each plant and containing a cross-section of the principal devices; also including a few pictures illustrating special features.

Federal Department of Public Works

The creation by Congress of a national Department of Public Works is now said to depend on the efforts of contractors, architects and engineers to secure sufficient support for it in the next session of Congress. The bulletin of the Associated General Contractors' of America urges the members to make speeches, explain why a public works department is wanted, and give abundant financial support. A strong appeal is made for subscriptions to a working fund of $10,000 to promote the creation of the department and a letter, approved by the president and secretary of the association, has been mailed to the members and has already elicited a number of worth while subscriptions and the promises of more. The letter is as follows:

May 31, 1920.

"We will be benefitted more than any other body of men by the creation of a National Department of Public Works, for the establishment of this department will mean the grouping together of Federal bureaus charged with the expenditure of more than two hundred fify million dollars' worth of public money.

In the past this work has not been considered worth going after. There has been too much red tape about it—too much diversity of specification—too little certainty that good business methods would be used. And so most of us have stayed away from it.

If it were handled by business men in a business way it would be well worth our while. It would mean the opening of practically a new field to us.

The engineers and architects have done most of the work that has been done towards the enactment of the bill so far. They are all back of it, and the department is going to be established. But they ask that we carry our share of the load.

Sixty thousand dollars is required to meet the expenses of the Association. They ask that we furnish ten thousand dollars of this amount. That means about twenty dollars for each member of our Association. Let everybody get behind this thing and help put it across. Fill out the subscription blank and send it to Secretary Buchholz. He will forward it on. Don't put this off. It is up to us to carry our part of the load.

Very truly yours,
F. L. CRANFORD

New York Dock Improvements

The Dock Department of New York City is engaged in carrying out an ambitious plan of water front improvements, far eclipsing anything before undertaken by the city in the way of terminal improvements. Twelve piers are being built on Staten Island which are estimated to cost $18,000,000 and which range in length from 1,000 feet to 1,600. Eight of these will be 125 feet wide, covered with steel freight sheets, two will be 130 feet wide, with double-deck steel freight sheets, and two will be 209 feet wide with double-deck steel frieght sheds Ten of the piers have provision for a double track railroad.

Also there are contemplated a wooden pier at Barren Island for the Street Cleaning Department and a concrete pier for the same purpose and the reconstruction of a pier for the Board of Charities and Correction. Much additional work of only less importance is planned. Bids have been opened for dredging a Long Island City basin and basins and docks in the North, East and Harlem rivers. An extension platform about 100 feet long is being built for excursion steam boats on the easterly front of Battery Park. A number of storage sheds, piers, etc., are to be built in various parts of the water front, by both municipal and private owners or lessees.

Harbor Project of Wilmington, Delaware

The plans for the Wilmington, Del., harbor project have been completed. They call for a bulkhead along Christiana creek, eventually to be fifty-one hundred feet in length, but with an initial limit of about sixteen hundred feet. Back of the bulkhead will be transit sheds, storage warehouses and various tracks.

The municipal wharf is already about eighty per cent completed. It is being utilized now, and numerous calls for docking privileges have been received.

Reports from many employers in Cleveland and surrounding centers, say that labor is showing a disposition to give a better day's work for its wages than has been reported for many months past.

Industrial Harbor for Lake Calumet

The Harbor Commission of Chicago's City Council is considering plans for a large industrial harbor at Lake Calumet, which would form a link in the "Lakes to Gulf" waterway. The project includes 93 acres of water area for the harbor, a central basin of 471 acres, 14 miles of water frontage and 14 huge slips. A belt line railroad having connections with 15 railroads would surround the harbor.

Power for Alabama from Mussel Shoals

At the present time forty cities in Alabama, several car lines, 35 coal mines, many cotton mills and graphite mills, and others are operated by 90,000 horsepower available from the Coosa development; but with the completion of the dam at Muscle Shoals there will be available 830,000 hydro-electric horsepower. Construction of this dam has so far progressed that bids have been received for installing electrical apparatus to produce 120,000 hydro-electric horsepower, which is one-fourth of the total power available at this point.

Subway Contract Relet

The contract for the completion of the 14th St. Subway, New York, which was commenced several years ago by the Degnon Contracting Company and abandoned after the city refused to allow an increase in the price following the advance in cost, has just been awarded to Patrick McGovern for $3,364,000 and is required to be completed in 15 months.

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Studying Sewage Plant Operation

Reporting on the considerable number of sewage treatment plants in his state recently, a State Health Officer said that the majority of them "at least did the sewage no harm" but that very few of them were of any appreciable benefit; this being due to inefficient operation rather than improper designing, in the majority of cases.

A water works filter is generally operated with great care because every consumer is interested in the results obtained by it, but a sewage treatment plant is of little interest to any one in the city operating it and consequently receives little attention or thought. It was probably built merely to meet legal requirements of state laws enforced by a State Board of Health or by the courts through injuction proceedings, and the plant having once been completed satisfactorily, the courts lose all interest in it and the State Health Board has not a sufficient force to permit keeping track of the operation of all plants.

This neglect of operation not only results in a failure to secure effective results from the money spent and to permanently eliminate the nuisance which led to the construction, but very greatly reduces our knowledge concerning the operation of such plants and thereby retards the development of the science and art of both operating and constructing them.

As described elsewhere in this issue, the United States Public Health Service has begun a survey of a number of plants, including examples of all of the more commonly used types, with the idea of placing in publicly available form all the information obtainable concerning these plants, and also reducing it to equivalent terms so as to make possible a reliable comparison of results in plants operating upon different principles and under different conditions.

There can be little doubt of the value of sanitary engineers of this investigation, and it is hoped that it will stimulate more interest in the subject and result n the adoption of uniform methods of keeping records which will permit a comparative study of plants, gradually including practically all of those in the country, and thus make for a much more rapid and general advancement of the science of sewage treatment.

As a beginning of this spread of interest from federal to local authorities, it is natural and desirable that state health boards take more active control of the operation of all the sewage treatment plants in their respective states. Many of them are not given sufficient funds to permit this, and the first move would be an education of the legislators and public to the desirablity of such supervision. In such education it would seem as though the Public Health Service might render much help.

Economics of a Great Aqueduct

The Winnipeg aqueduct, which consists chiefly of a concrete conduit nearly 100 miles long with a capacity for 100,000,000 imperial gallons daily was, on account of its magnitude, location, and requirements, a necessarily costly construction the minimum burden of which was very heavy for the new and thinly settled country in which it was built.

It was therefore recognized by the experts who were retained to plan the general system that the greatest simplicity and economy consistent with safety and efficiency were indispensable, and the general plans adopted in 1913 were based on these principles and contemplated a structure reduced almost to its lowest terms.

The construction of the aqueduct almost entirely within the period of the great war subjected it to conditions very different from those anticipated in the original design and involved greatly increased cost of labor and materials, scarcity of numbers and inferiority of quality in workmen, and other disadvantages that would naturally greatly increase the cost and delay the work. Nevertheless it was found possible to maintain the quality of the work and complete it practically within the required limits of time and expense by extraordinary attention to the simplification and accuracy of the design and by special cooperation of the engineering department with the contractors so as to eliminate unnecessary cost and delay and reduce the expense to an absolute minimum.

The character of the design and the scrupulous care with which it was adapted to the varying possibilities of the problem are evident throughout the series of articles commenced in Public Works, July 3.

The construction features involved thorough co-ordination of the city, the engineer's department, and the various contractors and were handled with great skill by the engineer whose foresight, thorough analysis of the problem and tact enabled him to handle the work throughout in such a way as to conduct it to the best interest of the city and often to the advantage of the contractor without in any way impairing its quality, assuming any of the responsibilities of the contractors or interfering with their freedom. This resulted in a large saving of time and money to all parties concerned and in a remarkable continuity and efficiency of the construction operations.

As the aqueduct passes for a large part of its length through swamps and pathless forests where transportation was slow, uncertain and costly, a great advantage was attained by the city's construction of a parallel service railroad over which the materials, plant and workmen were quickly and regularly delivered to all parts of the work at a much lower cost than could have been done by the contractors independently, and at a minimum total outlay.

This was supplemented by the policy of the city in providing concrete materials that were always ready in abundance and were of uniform and satisfactory quality, permitting the work to be carried on advantageously and eliminating delay, uncertainty and considerable middleman's profit.

An important element in the rapid and sustained progress of the work was the preparation of weekly reports and records of the progress and conditions of construction, which clearly showed if the contractor was up to the mark; and when he was behind time he was promptly penalized, but was reimbursed after he had caught up with the schedule, a system which proved very beneficial and satisfactory.

The engineering department was also well posted in advance as to all future requirements and supplies, and made arrangements to have all local plant and materials on hand on or before the date when they would be needed, thus almost entirely eliminating unnecessary delays and interference of simultaneous or successive operations.

$1,565,000 Wasted on Municipal Construction

The award of a contract for more than $3,000,000 to complete the construction of the 14th St. subway line, New York, is noted on page 106. Although it is probably the best thing that the city can do at the present moment to put this important and much needed transportation unit into service, it involves a wholly unjustifiable and unnecessary waste of at least $1,565,000 of the tax payers' money, a great injustice to honorable and efficient contractors, and a long period of inconvenience and distress to the traveling public, besides the direct injury to the prosperity and development of this city.

The work was originally contracted for by an experienced and competent contractor for the sum of $1,972,349, but was delayed in various ways for which the contractor was not responsible, and the enormous war increase of cost of labor and material made it impossible to complete it for the originally fair price. The contractor, anxious to carry out his obligations and willing to forego the estimated profits, offered to complete it notwithstanding the heavy loss, if the city would increase the remuneration by $626,000 over the original price. This offer was approved by John H. Delaney, transit construction comissioner, but rejected by the Board of Estimate, and in July, 1919, after about 35 per cent of the work had been fiinished, the contract was abandoned by the contractor.

After waiting one year during which time costs have considerably increased and the public has been suffering severely for the use of the subway, the Board of Estimate has been compelled to award a new contract at a price including the $626,000 increase petitioned for by the original contractor and the addition of $2,738,000, about $1,565,000 of which is a total loss to the city that would have been saved if the city had granted the contractor's reasonable application, which probably came within the special legislation provided to relieve municipal contractors suffering from war conditions. Unfortunately this law is only permissive and not mandatory, and the city has manifested a consistent determination to avoid such payments, even when promised. This has worked extreme hardship and injustice to many honorable and efficient contractors who have taken pride in executing their obligations notwithstanding heavy losses. It has also subjected the city to very great loss and inconvenience and well earned for it a reputation of unfairness to contractors, which will deter competent contractors from undertaking city work except at prices that would be outrageously high under fair conditions.

Cooperative Housing in Italy

In a periodical called "Housing," issued by the British Government, there appeared recently an article by S. Hurst Seager, describing a novel housing scheme observed by him in Rome. Of the article we have made the following brief abstract:

There are few detached homes in Rome and it is natural therefore, that housing schemes should follow the general plan of arranging a series of houses around a garden. Some of these blocks of houses have interior court yards which are well laid out and planted and some contain a fountain continually playing. An institute has been organized for the building of homes for laborers, and this builds separate houses in blocks of four to six, each with a separate entrance, the houses having nothing to differentiate them from the homes of the well-to-do except that they have only three or four rooms.

The largest scheme in Rome is on the Aventine hill. Here the buildings are erected in a substantial and workmanlike manner under a very interesting system. There are no building contractors, but every branch of work is let to the workers themselves as represented by their unions. The work is not done any more cheaply than if carried out in the ordinary manner, as the primary object of the Institute is not so much to effect a saving as to encourage the men to take a genuine interest in their work; while the object of the unions is to enable their members to carry out work in a cooperative manner and thus be free from the wage system. So far as Mr. Seager could judge, the scheme appeared to achieve these purposes.

He also reports that there are many blocks of dwellings and some groups of individual homes which have been erected on the cooperative principle by those engaged in a particular branch of Government work, such as the railway, post office and telegraphs, etc. To these groups of workers the Government has loaned a large proportion of the required funds at a very low rate of interest.

Concreting Plant and Operations

Conclusion of article begun last week giving a general review of advanced field operations and equipment. This installment deals with mixing machines, distribution and placing of concrete, the pneumatic process, and concreting under water.

MIXING MACHINES

Concrete mixing machines are standard equipment that can always be readily bought and sold in the market. As they are always subject to very hard service, often continuous, and liable to abuse and neglect, it is essential that they be of simple design, heavy construction and first-class material and workmanship. Most of them are of the drum type with revolving body and interior blades, which lift and drop the aggregate until it is well separated and mixed, the principal differences being in the details and in the manner of charging and discharging them. Considerable variation is found in the different patterns that are specially adapted for differnt kinds of work, those for paving, for instance, being entirely different from those for building construction.

They can be purchased of varying size from a fraction of a yard to several yards capacity, but the general tendency is toward a large number of smaller sized units; one yard machines being about the average for ordinary large jobs. Where concrete is deposited in very large masses and with the greatest rapidity, special larger machines may be used to advantage, but in any case, it is more desirable to have several machines than to have one, because this provides a reserve and allows one or more to be out of service for shifting or repairs without entirely stopping the output. A multiplicity of mixers enables them to be distributed at different parts of a large piece of work, thus diminishing the distance which the mixed concrete must be carried.

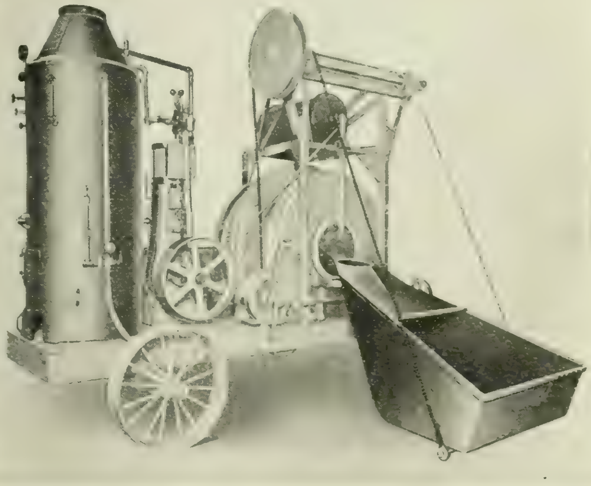
It is desirable that all mixers on the job should be of the same make and, as far as possible, of the same size, so as to provide for interchangeability of parts and reduce the extra pieces kept on hand. They may be installed in batteries of two or more; they should be fed from the same bins and operated from the same charging platform, thus reducing the number of attendants and the cost of installation. They should be mounted on steel or timber skids on a solid foundation with suitable protection, and at an elevation sufficient to enable them to discharge directly to the distributing cars or hoisting buckets; if necessary, however, the latter may be placed in the bottom of a pit, thus reducing the elevation of the mixer.

Where small units of construction are to be scattered over a large area, as in the case of foundation piers, long walls, or similar construction, it will be found convenient to have one or more small portable machines moving from place to place according to the progress of the work. Where a daily output of 100 yards or more is required, two small machines are generally better than one larger machine, both because they make a much more elastic system and can be separated and transferred to other work, and because the freight and installation charges are much less than for the equivalent large machine.

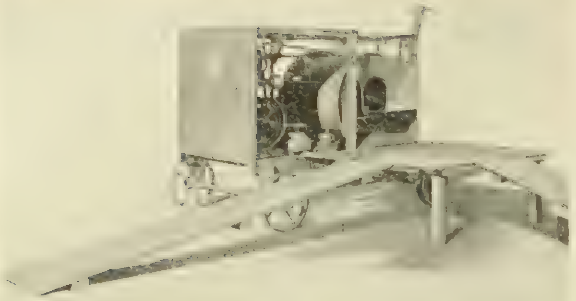
LOADING MIXERS

Portable machines are usually equipped with a power loader or a loading platform, the latter usually costing 25 or 30 per cent less than the former, which has 20 or 30 per cent greater capacity than the platform machine. Where conditions limit the amount of concrete required to 50 yards or less daily, the platform machine is probably the most economical. Where these machines are charged by hand shoveling, great care should be taken to establish a minimum consecutive cycle of operation, so that no time is lost or interruption or obstruc-

RANSOME ROAD PAVING MIXER



STEAM DRIVEN BUILDING MIXER WITH CHARGING HOPPER



GASOLINE DRIVEN BANTAM MIXER WITH INCLINED WHEELING PLATFORM

tion occasioned by the men getting in each other's way, or waiting for each other.

Each man or party of men should work continuously in the same routine, particular care being taken to avoid confusion or collision between men approaching and those leaving the charging platform. A one-bag machine will require five wheelbarrow loads of 2 cubic feet capacity for each batch, and as each load requires at least 35 seconds for delivering the material, 10 seconds for operating the hopper, and 30 seconds for mixing, a minimum of 75 seconds will be necessary for each cycle. With wheel-barrows of 3 cubic feet capacity, the cycle may be reduced to a possible 61 seconds, although the tendency is growing to require a full 60 seconds for mixing operations alone.

A power loading machine of 11 cubic feet capacity, called a one-bag machine, requires the same wheelbarrow time for charging but, as the hopper can be loaded while the mixing is in progress, only 12 seconds is required for elevating and discharging the hopper, and the minimum cycle is about 52 seconds. With gravity storage bins, the automatic charging of the hopper requires about the same time for any size batch up to two or three yards capacity; the time of charging will hardly exceed one minute, thus giving a maximum speed of 30 batches per hour allowing a full minute for mixing.

The ideal arrangement of supplies for wheelbarrow charging is to have the sand and broken stone on opposite sides of the mixer, so that a wheelbarrow bringing a load of sand continues in the same direction across the platform and loads with stone returning; delivers the stone and continues to the sand pile; and so on back and forth, shuttle fashion, with no lost time or empty trips.

Water supply should always be carefully measured and fed into the mixer before the sand, cement and broken stone. Since too much water will injure the quality of the concrete and too little will not materiallly affect the operation of the machine, it is better to have too little than too much. In cold weather the water should be heated before being delivered to the machine, which is easily accomplished by running steam coils through the supply tank, or by injecting live or exhaust steam into the water through a perforated or open-end pipe.

HEATING MATERIALS

It is also necessary in very cold weather to provide systematic provision for heating the aggregate. This is best done by installing steam coils on the bottom and around the sides of the storage bins or under the storage piles; low pressure or exhaust steam is satisfactory for this purpose and should be provided in abundant quantities. If the steam supply for operating the mechanical plant is not abundantly adequate, an additional old boiler may well serve the purpose, if installed especially for this service.

For small size, temporary or detached operations, it may suffice to heat the sand, gravel or broken stone over horizontal flues in which a wood, coal or coke fire is maintained. Steam is also sometimes injected into the mixer during its revolution. If the concrete is delivered to position at a temperature well above freezing, and the upper surface is well protected, the heat developed by the chemical processes of setting will usually prevent it from freezing except in extremely cold weather. When concrete is placed in small masses, however, the forms need protection against frost, whenever the temperature is much below freezing.

DISTRIBUTION AND PLACING OF CONCRETE

Concrete mixers usually deliver directly into dump cars or buckets, the former being used when the concrete can be discharged directly into the forms at a lower elevation, as into foundation pits, or from a trestle into wall forms and the like. Concrete buckets are usually transported for short distances by cableways and for longer ones on cars or automobile trucks, whence they are generally unloaded by derricks commanding the forms into which the concrete is emptied. The cableway usually brings the buckets into position over the forms where they are dumped directly, but it may deliver them to derricks or other plant which transfer them to required positions. The buckets should usually be of proper size to take one batch of concrete, unless they have to be transported for long distances, when they may take two or three batches at once. Tilting buckets may be used, but bottom dump buckets are generally preferable and are indispensable for depositing concrete under water. Special buckets with adjustable gates are used for narrow forms and special purposes.

SPOUTING

For building construction, dams and other structures, concrete is frequently delivered from the mixing plant to a bucket at the foot of a hoisting tower, from 50 to 200 feet high, in which it is elevated to a receiving hopper at the top or at any intermediate point, where the contents are dumped. Usually the receiving hopper is provided with a gate through which the concrete is delivered to an inclined tube or trough, which spouts it to different portions of the work. Considerable advantage in spouting is derived from mixing a small proportion of hydrated lime with the cement, which makes the concrete more plastic and slippery. The proportion of mixing water should be about 1¼ to 1½ gallons per cubic foot of concrete.

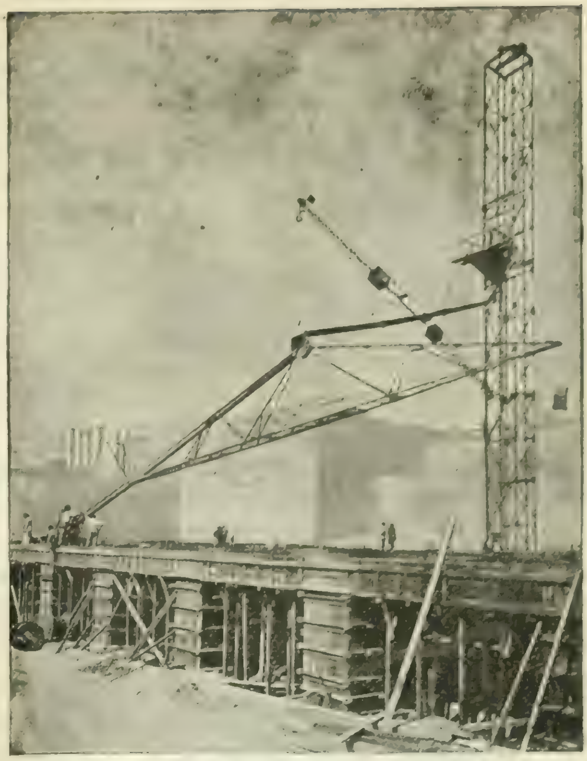
The chutes are generally made in long sections of steel troughs, trussed and connected at the ends with swivel joints, supported in such a manner as to allow each section to be revolved through a wide horizontal angle, the last section delivering directly to the forms or to a small charging hopper, from which two-wheel carts are filled to transport the concrete a short distance. About 200 or 300 feet is the ordinary practical limit for spouting concrete (a maximum distance of 700 feet has been recorded), and when this is materially exceeded, sometimes the concrete is delivered to a second bucket at the foot of an auxiliary hoisting tower, where it is elevated and spouted again.

The chutes are often suspended by adjustable light tackles from overhead cables, one end of which is carried at the hoisting tower and the other end at another tower or even extended to the ground beyond the limit of the work. The first end of the chute is always supported directly from the hoisting tower, and sometimes the outer end is carried by a boom attached to the tower, through which the chute passes. A second chute is often carried on the top chords of a cantilever truss and supports one end of a third chute, which generally is supported at the outer end on a light tower or trestle moved from place to place on the work.

PUSH CARTS

When the concrete cannot be spouted to the forms in which it is to be placed, it is generally distributed for distances up to perhaps 100 feet in two-wheel hand-pushed dump carts running on plank platforms laid on the surface of the ground, on the floor, on trestles, or on top of the forms. This final distribution is often used for handling the concrete for large buildings, where the spouting may be eliminated, and the hoisting tower may deliver to loading hoppers on the successive floors.

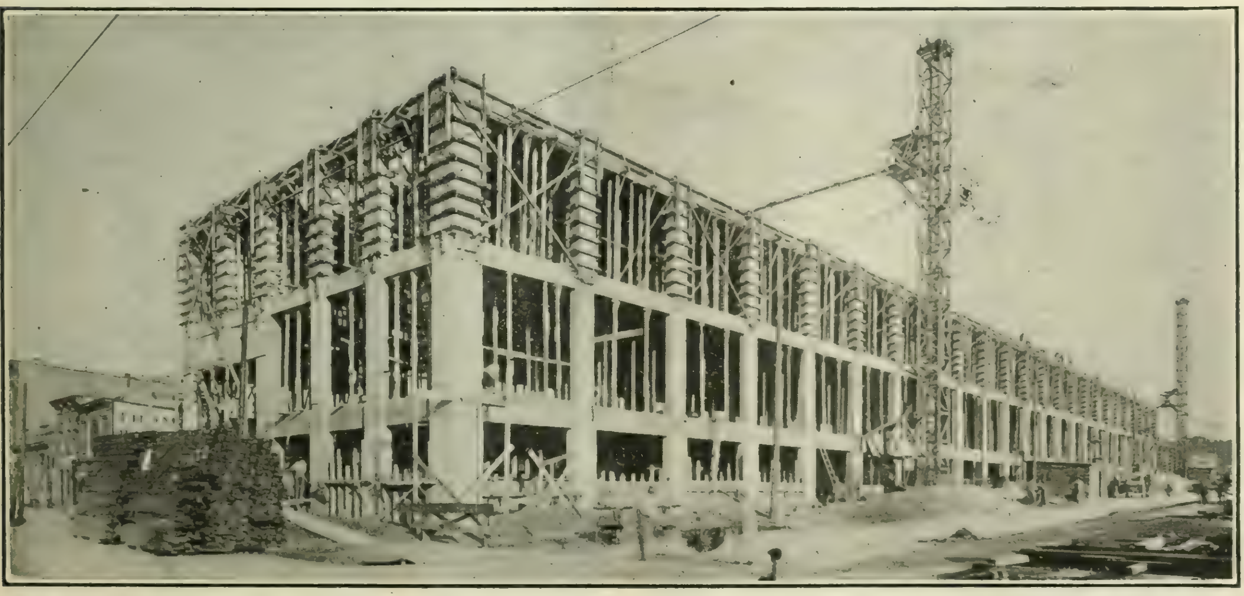
In other cases, the two-wheel carts may receive the concrete directly from the mixer and distribute it up to a maximum distance of several hundred feet. The runways for these carts should be made of light boards, cleated together in panels from 8 to 12 feet long, that can be very readily shifted and easily supported on blocking or trestles to provide for the proper grade, which should be from 1 to 2 inches in 10 feet, in favor of the loaded carts, not sufficient to accelerate their speed unduly or to make severe work pushing the empty carts upgrade.



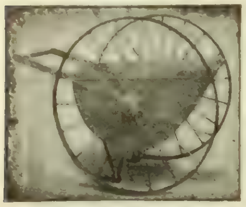
STEEL HOISTING TOWER WITH COUNTER-BALANCED TRUSSED CHUTES

A 250 x 250-foot concrete slab 10 feet thick was concreted from a single mixing machine that delivered into carts running on a platform 6 feet wide and extending across the full width of the concrete slab on the center line. It was elevated about 6 feet above the slab and graded down about 1 to 500. On each side of this platform there was provided at the same level a movable transfer table of the same width, extending across the slab transverse to the main runway.

The 25 two-wheel carts were operated in pairs simultaneously filled from two gates of the loading hopper at the mixer, and one was pushed out on a



CONCRETING SHOP BUILDING WITH DUPLEX SYSTEM OF WOODEN HOISTING TOWERS AND TRUSSED CHUTES transverse runway on one side and the other on the other side, from which they dumped their contents to the slab and returned. The grade of the runway was sufficient for the loaded cars to move by gravity at a speed which made it necessary for the attendants to hasten and made the work so rapid that it was necessary to relieve the men at short intervals. This method gave 100 per cent efficiency, removing the concrete as fast as the mixer could deliver it, which is an unusual record for any construction work.


CONCRETE CART

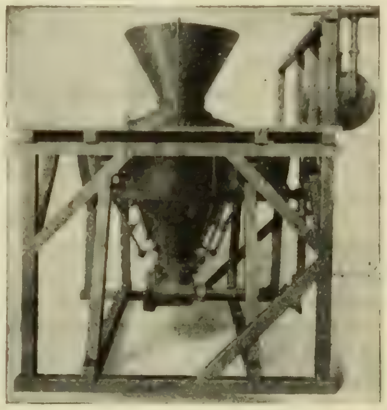
PNEUMATIC PROCESS

For years the mixing and placing of concrete by pneumatic pressure had been considered a *desideratum*, and considerable progress has been made in developing such a process. There are on the market numerous types of mixing machines in which the cement and aggregate are charged and subjected to jets of compressed air from several nozzles that tend to mix the materials; a gate is then opened, and the entire batch is forced through a pipe that discharges into the forms. Considerable difficulty has been experienced in securing a satisfactory and thorough mixture, but good results have been obtained by mixing the cement and aggregate before delivering it to the pneumatic mixer.

PORTABLE STEEL HOPPER

The pneumatic conveying portion of the apparatus has however proved very advantageous in some cases, especially where there is very limited clearance; notably in tunnel construction, where concrete for the lining can be delivered from the top or bottom of the shaft through a pipe laid on the invert or along the tunnel wall and occupying so little space that it does not interfere with tunnel cars or the other construction operations. On the other hand, the transportation of concrete in buckets or dump cars would very much obstruct the work, particularly in tunnels of small diameter, where only a single line of track can be used.

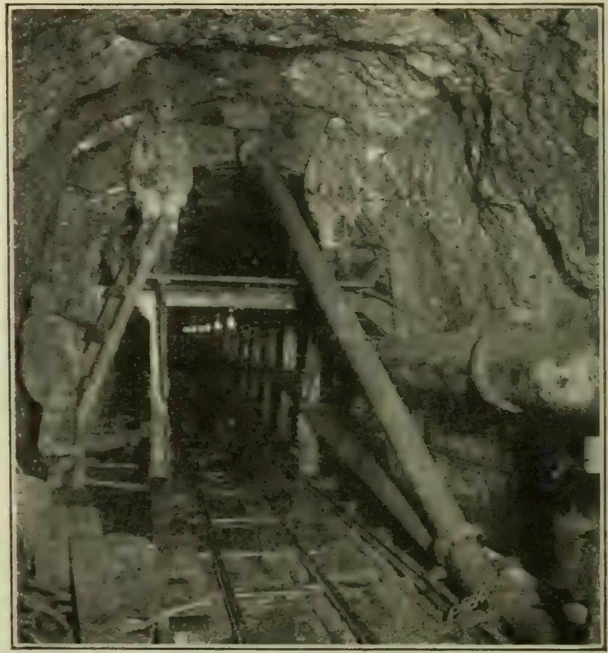
The delivery pipe is usually from 4 to 6 or even 8 inches in diameter and can be laid at any grade or even with perpendicular sections, but either horizontal or vertical deflections should be made with long radius bends. The concrete can be delivered through horizontal distances up to 1,000 feet or more, and can be raised 50 feet with a working pressure of 100 pounds or less.


RANSOME CANIFF PNEUMATIC MIXER AND CONVEYOR

The system is of course costly to install and it is found to require a very large amount of compressed air for its operation. It may, however, be economical when the cost of placing concrete by other methods exceeds $1.50 per cubic yard. The concrete quickly wears out the pipe at the bends, where holes are cut through the outer side of the curve, and the pieces require frequent patchings or renewal and are generally reinforced or made extra heavy or have detachable pieces at the exposed points.

CONCRETING UNDER WATER

Submerged concrete is usually placed in solid masses not requiring reinforcement or exceptional


CONCRETING TUNNEL LINING BEHIND STEEL FORMS AND STEEL TRAVELER WITH 8-INCH PNEUMATIC PIPE

tension strength. It should, however, completely fill the forms making a solid mass and be protected so as to preserve its integrity until hardened and to prevent the washing away of the cement. Submerged concrete may often be placed in the dry, and water may be excluded until the concreting is completed, as in cases of concrete placed inside pneumatic caissons or cofferdams, or when a structure is concreted in a floating cofferdam sunk to position on a prepared foundation.

This last method is occasionally used for bridge piers, sea walls and the like, where the caisson itself is sometimes a plain or cellular concrete box, or where the system can be adopted that was recently devised by J. W. Rollins. His scheme consisted of building on shore a wooden cofferdam, detachably connected with a water tight joint to a permanent solid concrete base; this box-like structure was launched, towed to position, and gradually sunk on the foundation as the interior permanent structure was built up on the concrete bottom. After the work is brought above water level, the detachable sides can be removed and used over again, thus effecting great economy and rapidity.

With proper care and equipment wet concrete can be safely deposited through and under the water, usually without much and sometimes without any work from divers, which is always costly. However, it may be desirable to have the bottom prepared to receive the concrete or to have it inspected by divers before the concrete is commenced and while it is being placed.

For depositing under water concrete should never be of a lean mixture. Gravel is a more satisfactory aggregate than broken stone, because it flows more easily and is less liable to obstruction and the production of cavities. The materials should be delivered by boat if the water has sufficient depth, in which case the floating plant will usually be more satisfactory for a large job. On the other hand, when the materials are received by rail or the plant can be installed on shore or on an adjacent structure, a fixed plant may be most desirable. Other things being equal, the concrete can be handled from the mixer most advantageously by ordinary derrick booms, although sometimes cableways with very large buckets are suitable.

When a large area is to be covered with submerged concrete, it should be uniformly deposited in a continuous layer, 2 or 3 inches thick, with the strips zig-zagging back and forth continuously across the surface. An irregular surface of fresh concrete may sometimes have to be leveled by a straightedge drag or screen, heavily loaded or operated by divers.

Submerged forms for retaining masses of concrete may be built up to a limited height from an irregular bottom with jute or paper bags of fresh concrete handled by divers and built up like walls. Concrete in small quantities may thus be placed under water for many different purposes, the cement permeating the woven fabric of the bags and making a solid monolithic mass which may or may not be the case when it is placed in paper bags, although the fabric of the latter is generally believed to dissolve and allow the concrete units to bond thoroughly together.

BOTTOM DUMP BUCKETS

Concrete cannot be successfully dumped into the water from a point above the surface nor deposited by lowering through the water in a tilting bucket, because the combined action of water and gravity tend to separate the fine and coarse particles and wash out the cement. The bottom and sides of the concrete should be protected from the water, but the top does not need special protection. A great deal of submerged work can be satisfactorily executed with a good bottom-dumping steel bucket, particularly for small areas and in protected spaces such as the interior of cribs, caisson pockets, and dredged wells, where there is little current of water to be contended with.

A bottom-dump bucket may be provided with a tripping device to release the bottom flaps when it is just above the required emptying position; it is better, however, to have the sides extend a few inches below the bottom flaps and the latter arranged so that when the bucket comes to rest on the lower edges of the sides, the flaps are released; the bucket then automatically discharges its contents, still protected by the extended sides and left exactly in the required position when the bucket is withdrawn.

It is important that the top of the bucket be left open so as to avoid the formation of a partial vacuum that would not only retard the emptying of the bucket, but would eventually set up a washing action that would injure the concrete. Submerged bucket work should be done with large masses of concrete and as little exposure to washing as possible, buckets up to 4 or 5 yards capacity being desirable when conditions permit.

TREMIE METHOD

When there is considerable lateral clearance and a large mass of concrete to be deposited under water, excellent results can be obtained by the tremie method, which consists simply in depositing the concrete through a tube, usually vertical, extending from above water level to the point of deposition of the concrete under water.

The great essential in this method is that the tremie shall be kept always filled with concrete and the operation shall be carried on continuously, so as to cause the uniform distribution of the concrete and maintain a concrete seal at the bottom of the tremie, thus preventing the entrance of water. The tremie, mounted on a carriage that is provided with both transverse and longitudinal motion or supported by a derrick boom or other suitable apparatus, is provided with a hopper at the top which must be kept filled from the adjacent mixer.

At the beginning of operations the tremie is full of water, which is expelled by the first concrete that enters it; the concrete, however, becomes washed in falling to the bottom, so that it should be thrown away and operations commenced with concrete supplied after the first contents of the tube have escaped. The bottom of the tube should be maintained embedded a few inches in the surface of fresh concrete, thus providing a seal and enabling the full length of the tube and part of the hopper to be maintained full of concrete, which can only escape as the bottom of the tube is moved forward transversely to the end of its course. At this stage it should be shifted slightly longitudinally and moved back in a parallel transverse direction, and thus moved back and forth in a zig-zag fashion until the whole area of the structure has been covered.

In this way the concrete builds up in successive, uniform, continuous, horizontal layers with as little interruption as possible; it may be necessary to raise the tremie and start operations over again if it has to be shifted from pocket to pocket of a caisson, or to avoid horizontal braces. On this account, where the obstructed horizontal area is less than 200 square feet, the use of a bottom-dumping bucket is likely to be more economical than the tremie. The tremie should be large and arranged so as to be easily and accurately handled, and great care should be taken to maintain a continuous supply of concrete and prevent any interruption to its deposition under water.

For the piers of the Charles River Bridge, Boston, many thousands of yards of concrete were deposited in masses up to 62 x 207 feet and at a depth of 30 feet below high water; the tremie used was 35 feet long, 18 inches in diameter at the top and 24 inches at the bottom, and was suspended from a 6-yard hopper car traveling on a transverse bridge. The bridge itself rolled on longitudinal track extending the full length of the cofferdam, and commanded all parts of its area.

The hopper was kept constantly filled with concrete and was discharged through a bottom gate as the car moved, depositing it at the rate of about 40 yards per hour. Another important case of successful tremie concreting was that of the four-track subway tunnel across the Harlem River. There a large quantity of concrete under, around, and over the four steel tubes, and inside a steel cofferdam and bulkhead was placed by several tremies mounted on a floating platform.

Labor Notes

Among the items in the **Industrial News Survey** of July 12 published by the National Industrial Conference Board are the following:

Brotherhood of Surface Employees of Brooklyn, N. Y., rapid transit association has taken out papers of incorporation.

Central Labor Union of Boston has voted that after October 2, 1920, no alien will be eligible as a delegate to that body unless he has taken out citizenship papers or filed his intention of doing so.

Textile Union (Paris) recently passed resolution protesting 48-hour week and declaring that it is an "imperative necessity to restore the maximum production to industry by an intensive effort," and demanding purchase of material and machinery for industries ruined by the war. without further delay; also appealing to public opinion urging strict economy on part of the consumer and increased activity in every department of labor as only true means of combating the high cost of living.

White Motor Co., Cleveland, Ohio, has issued declaration of principles governing its industrial relations which has been approved by committee of elected representatives of workers who meet with the management to consider plant problems. The maxims of the declaration state "Capital is only production minus consumption"; "Business originally founded on service"; "The customer pays all"; "The public suffers all"; "Absentee ownership may or may not be a curse"; "Absentee management is always a curse"; the principles are, "No entangling alliances"; "Free speech"; "Free press"; "Recognition of individual rights"; "No discrimination against nationality, political belief, or creed"; "no discrimination against any organization"; "base wage, based on buying power"; "Craftsman's wages adjusted to the above."

The first maxim, at least, is worthy to be included with the famous "Fourteen Points."

New Orleans Car Strike

The entire transportation system of New Orleans was completely paralyzed July 1, by a strike of the street car employees who, some hours after quitting work, announced that they were ready to discuss their differences with the federal receiver for the New Orleans Railway and Light Company, on whom they placed the responsibility because they charge him with having failed to grant them a wage of $150 per month that has been suggested as a living wage. The chairman of the Business Mens' Committee considered that the committee had been treated shamefully when, after endeavoring to avoid the strike, they sent a petition to the strikers before the latter took action, which was not even acknowledged.

Another Closed Shop Strike

A strike on the municipal contractors for garbage disposal in Philadelphia is emphatically stated by the employees to be a fight for closed shop, the demands of the strikers not being a genuine popular request, but being made at the dictation of a few agitators although the men themselves desire to work.

Distribution of Immigrants

The official money-changer for incoming aliens landing in New York is quoted as stating that the money exchanged for those whose destination is New York City does not amount to 1 per cent of that exchanged for those giving other points as their destination. The immigrants are now going in greatly increased proportion to manufacturing centers such as Pittsburgh, Detroit and Akron, Ohio or to the coal and iron mining regions.

Immigration to New York

The present rate of immigration to New York City, about 10,000 per weak, is only one-quarter as great as the pre-war maximum, but a considerable portion of the diminution is attributed to the loss during the war of 25 large passenger ships. It is also influenced by literacy tests and by the efforts of the European governments to keep their citizens at home. Out of the 10,000 weekly arrivals, 6,000 are women and children and 2,000 are aged persons, leaving only about 2,000 able-bodied men, most of whom are reservists. These are chiefly soldiers who were called home from the United States to participate in the war and have now been discharged. There are practically no immigrants from Germany, Austria or Russia and the great majority of those that do come are Jews from all countries.

Slowly Increasing Labor Balance

According to the records of the year ending June 30, compiled by Commissioner Wallis of the Ellis Island Immigration Bureau, the total number of arrivals and departures of aliens from this city during the year were respectively 314,468 and 334,254 showing a net loss of population of 19,786.

This loss, however, occurred entirely during the first part of the year, while the figures show that in the last months the ratio was in the opposite direction, with arrivals 29,098 in March and 47,715 in June and corresponding departures of 26,169 and 37,585, showing in the last month an excess of immigrants over emigrants of 10,130, a number which would have been considerably larger except that the departures had increased much more rapidly over those of the preceding month than had the arrivals. The favorable balance was greatest in May, when there were 40,048 arrivals and 21,162 departures showing a balance of 18,886 in our favor. This goes to show that America is still more attractive than Europe to laborers and that the depleted labor supply abroad is still able to furnish an increasing supply for us if legal and transportation difficulties permit.

Increased Arrivals of Immigrants

During the week ending July 10, 13,161 aliens were landed at Ellis Island, New York of whom 11,161 were steerage passengers and 2,000 were cabin passengers. A marked change in the character of immigrants is noted in the fact that, unlike the previous recent arrivals, the percentage of men was larger than that of women and children, notably so on the steamship Mexico which brought only 14 women and 552 ablebodied men and boys 16 years old and upwards. These all came from Portugal and were enroute to Massachusetts or California where there have been established large Portugese settlements.

In 1914, just before the beginning of the European war, the tide of immigration to this country reached the enormous total of 1,403,000 but since June 30 of that year there has never been a single week in which 13,161 aliens arrived.

Waiting List for Europe

It is officially stated that more than 2,500,000 foreign born citizens of this country are waiting an opportunity to return to Europe and would now be departing in very much larger numbers if there was available sufficient transportation.

This does not, however, mean that these laborers will remain abroad. The indications are that as soon as they discover the high cost of living and difficult conditions left over from the war, a large proportion of them will be glad to return to America in the hope of finding better jobs, higher pay and pleasanter conditions in this country.

More Alien Arrivals than Departures

Papers recently furnished by the department of labor, Bureau of Immigration show that during the months of July, August and September, 1919, 65,333 immigrants arrived in the United States and 82,461 aliens departed making a net loss of 17,128.

During the months of October, November and December, 1919 and January and February, 1920, the arrivals amounted to 159,014 and the departures amounted to 122,444 showing a net increase of 36,570.

The above are the latest figures furnished by the bureau but current reports from Ellis Island where about 80 per cent of the immigrants for this country arrive, indicate that the ratio of arrivals to departures is rapidly increasing, and that the total number of immigrants is much larger than it has been for many years previously.

Assisting Immigrants

The National Americanism Commission of the American Legion has made arrangements with the Immigration Commissioner for forwarding to the different posts of the legion, the names and destinations of all immigrants so that legion members, preferably those who speak the alien language, can welcome them and help them to become 100 per cent American.

Farmers Want Immigrants

According to Chas. M. Gardiner, an official of the National Grange, the general sentiment among U. S. Farmers is for the encouragement of immigrants to the points where they are most needed. They should not be permitted to join existing large foreign colonies, some of which promote sedition and anarchy, and they should not include radicals and those of bolshevist tendencies that make the process of Americanization more difficult.

Labor in Washington

Reports from the state of Washington, announce a slight reduction in the shortage of foreign laborers and a considerable shortage of unskilled labor help in the western part of the state, while in Seattle there has developed during the last month a slight excess of skilled and unskilled labor.

The representatives of 75 South Carolina cotton mills have voted to maintain the number of working hours per week at 55 as a vital necessity.

Indication Reported of Increasing Labor Efficiency

In reply to a questionnaire issued by the Industrial Bureau of the Merchants Association, New York, 49 manufacturers representing 14 industries, reported in September, 1919 that in general, labor was not more than 70 per cent efficient judged by normal standards. The present report of the same manufacturers indicates some increase in efficiency, especially during the last four or five months. In general, the increase cannot be measured but is considered to be now underway.

Of the 49 letters, 23 announced a noticeable increase of efficiency since last September, five merely allude to a better spirit among their employees, 17 have observed no change, and 3 report a decrease.

Among various reasons suggested for the improvement are increasing number of applicants for positions and the change from time-work to piece-work.

One manufacturer reported a six weeks shut-down due to unsatisfactory relations on account of the union, followed by a complete change which has secured an increase of between 30 and 40 per cent in production with a tendency to still greater increase.

Another manufacturer reports that since inagurating piece-work, the output is entirely satisfactory, but that the output on time labor is fully 30 per cent below normal.

Philadelphia Strike Becoming Violent

The strike of Philadelphia laborers for almost double wage, reduction of hours from 10 to 8 and closed-shop has forced the employers in organized action to declare that if the men did not return to work they would be locked out, that the closed-shop would not be tolerated and that common labor must work 10 hours daily in order to keep skilled labor at work during 8 hours. As a result, the Trade Council has declared a guerrilla warfare to harass the employers by calling the men off from one important job after another.

Work on a number of important buildings has been stopped or very much retarded, strikers have attacked loyal workmen with knives, clubs and stones and serious disorders and arrests have been frequent.

Owners are afraid to commence operations on account of high prices of labor and materials due to strikes and transportation difficulties and contractors are unwilling because they cannot be sure that the men will complete the work after commencing it. The blame for this condition is laid not on the workers but on organizers and agents who keep the men discontended and excited.

Tunnels Wanted in Colorado

In November, the state of Colorado will vote on the initiative and referendum petition, for which more than 16,000 signatures have been secured, to amend the state constitution and provide for the construction of three summit railroad tunnels to cost $18,550,000 to be owned by the state and provide for trains, automobiles and army trucks.

Pennsylvania Automobile Licenses

License No. 469,000 was issued by the Automobile Division of the Pennsylvania State Highway Department on July 9th, and the Department predicts that over 525,000 licenses for pneumatic tired vehicles will be issued this year. The total issued for such vehicles in 1919 was 441,224. There has been an increase also in solid tired vehicles, the total on July 9th for the year having been 41,556, while the total for 1919 was 40,893. The total registrations of pneumatic tired vehicles for the six years from 1914 to 1919 inclusive, have been as follows: 104,950, 152,365, 218,846, 306,001, 363,001, 441,224.

A new New York State law restricts trucks and trailers operating outside of cities to a width of 8 feet, height of 12 feet 6 inches, and total weight of 25,000 pounds.

Coal Supply

In New York City, due principally it is claimed to tranportation difficulties, the danger of a coal famine appears to be growing larger rather than smaller. Notwithstanding that at this season of the year the consumption is a minimum and under normal coditions the reserve should be rapidly built up and stocks accumulated during the summer, the Public Service Commission reports that the combined stocks of all of the utilities in the city only aggregated 137,820 tons on July 12, showing a falling off of more than 50,000 tons from the previous week and leaving an extremely narrow margin of safety for regular operations.

Between the miners, the producers, the railroads, and the government as represented by the Interstate Commerce Commission, there is no difficulty in passing the blame for this situation back and forth from one to the other and as usual, the public and the individuals suffer.

Among those responsible, bad judgment and bad faith doubtless exist in several quarters and although part of the deficiency may be at present unavoidable, there is little doubt that the quantity is much samaller and the price much higher than there is any reasonable excuse for.

The violent disorganization of transportation that has resulted from the priority orders in favor of coal-cars does not cure the situation, in fact it does not efficiently relieve it; but it does work tremendous hardships and injustice to many other national interests, particularly to general construction. Until the profiteering of both labor and capital is under control and some very radical changes have been made and assistance provided to rehabilitate the transportation system that was wrecked and hamstrung by the government administration, we cannot hope for great or permanent improvement.

Recent Legal Decisions

DAMAGES FOR DELAY ON PUBLIC WORKS, WHERE LIQUIDATED

The Oregon Supreme Court holds, Star Land Co. v. City of Portland, 189 Pac. 217, that a provision in a contract with a municipality for the erection or construction of public works, such as street improvements, that for each day's delay in completing the improvement the contractor should as liquidated damages pay to the municipality $10 is valid and enforceable where the amount of damage would be practically incapable of computation, and therefore the provision could not be treated as a penalty.

CONTRACTOR ENTITLED TO RECOVER PRO RATA FOR ROAD WORK DONE BEFORE DEFAULT—CONTRACTOR HELD LIABLE FOR COST, NOT REASONABLE VALUE, OF COMPLETION BY ANOTHER

A contract was made with a county to make a dirt fill for the construction of a highway at 70 cents per cubic yard. The contract provided that in case the contractor failed to complete the work the county might complete at the contractor's expense. The total amount to be moved under the contract was 14,000 cubic yards. After the contractor had removed about 2,000 cubic yards, proper notice was given, the work was taken over and the contract relet at 92 cents a cubic yard. The county sued the contractor and his surety for the difference between the contract price and the reletting price, 22 cents per cubic yard. The contractor counterclaimed for the contract price at 70 cents per yard for moving 2,170 cubic yards. It was held, Bayfield County v. Agren, Wisconsin Supreme Court, 177, N. W. 591, that the contractor was entitled to recover on this counterclaim, such a contract being divisible, and not entire, as claimed by the county.

The question of cost of completion has apparently never been before the Wisconsin Supreme Court before. The trial court held that the burden was upon the county to show what the reasonable price of completing the contract was. The Supreme Court, however, thinks that the rule adopted by some courts, that when a contract provides that in the event of a breach of the contract by the contractor the owner may take possession and complete the same at the contractor's expense, and that the amount of recovery is limited to the reasonable cost of doing the work without reference to the actual expense thereof, works an injustice to the owner. "It is a matter of common knowledge," the court says, "that it is oftentimes difficult to procure labor to complete a half-finished job. Seasonal obstacles oftentimes present themselves. Difficulty in procuring material and competent workmen often renders the completion of the task more expensive than the doing of the same amount of work would have been under a continuous operation. . . . It is much more just and reasonable, under a contract authorizing the owner to complete the work at the expense of the contractor, to permit the owner to receive the actual cost of completing the contract, where the owner has acted diligently and in good faith, and there is no evidence of fraud or negligence. . . . An owner may not, of course, under such circumstances, proceed to make the completion of the work as expensive as possible, but where he does proceed in good faith and with diligence to have the work completed, he ought not to be subjected to the hazards of litigation to ascertain the amount due him from the contractor. The employment of experts in cases of this kind is not always a satisfactory substitute for actual experience, and the opinion of experts ought not to be admissible where there is no evidence of negligence or fraud. Zimmerman v. Jowigensen, 14 N. Y. Supp. 548 affirmed 144 N. Y. 656." Judgment for defendants was therefore reversed.

STATUTORY LIEN FOR CONSTRUCTING IMPROVEMENTS AGAINST SCHOOL CORPORATION PROPERTY

In an action by a contractor against an Indiana school township to foreclose a lien on the defendant's real estate for the cost of constructing a sidewalk abutting thereon, the Indiana Appellate Court holds, Cain School Tp. v. Synder, 106 N. E. 686, that the contractor was entitled to a lien under the Indiana act passed in 1903 to the effect that all common school corporations of the state shall be subject to the same duties and liabilities in respect to municipal assessments for the cost of public improvements affecting their real estate as private owners of real estate, and that their real estate shall be subject to liens on account of public improvements the same as if it had been owned by a private citizen, excepting only as to penalties and attorney's fees. The contractor has the right to have his lien judicially declared and established and the extent and amount thereof judicially determined.

ACCEPTANCE BY TELEGRAM MAKES COMPLETE CONTRACT—SUGGESTION OF MODIFICATION

A corporation engaged in the construction of buildings contracted for the erection of a courthouse and jail, and to furnish certain material therefor manufactured by another corporation. In an action by the latter against the construction contractor it was held, E. T. Barnum Iron Works v. Prescott Const. Co., 102 S E. 860, that the question whether a series of letters and telegrams passing between the parties constituted a contract was for the court, not the jury, to determine. Where an offer expressly or impliedly requires or authorizes acceptance by wire, the sending of an unequivocal telegram of acceptance by the offeree to the person making the offer constitutes the transaction a completed contract. If an offer is accepted as made, the acceptance is not rendered ambiguous or conditional by uniting with it an expression of hope or suggesting that some unimportant addition or modification be made in its terms.

NEWS OF THE SOCIETIES

August 14-18 ENGINEERING INSTITUTE OF CANADA, CALGARY BRANCH. Meeting at Banff F. C Emery, secretary. Western professional meeting, Calgary, Canada.

Aug. 26-Sept. 3 AMERICAN PUBLIC HEALTH ASSOCIATION. San Francisco. Office of Secretary.

Sept. 7-16 — NEW ENGLAND WATER WORKS ASSOCIATION. Annual convention, Holyoke, Mass., Sevretary, Frank J. Gifford, 715 Tremont Temple, Boston, Mass.

Sept. 13-17 AMERICAN PUBLIC HEALTH ASSOCIATION. Annual convention San Francisco, Cal.

Sept. 13-17 — SOUTHWESTERN WATER WORKS ASSOCIATION. Annual convention, St. Charles Hotel, New Orleans, La. Secretary, E. L. Fulkerson, Waco, Texas.

Jan. 25-27 1921—THE AMERICAN WOOD-PRESERVERS ASSOCIATION Annual convention. Place to be announced.

COMMITTEE OF EDUCATION FOR HIGHWAY ENGINEERING AND HIGHWAY TRANSPORT ENGINGEERING

This committee just established by the Department of the Interior of the United States, has been formed to study the relationship existing between the highway roadbed and the motive unit. It will also study various problems of highway development and make recommendations for more efficient administration of highway construction.

The committee, headed by T. H. MacDonald, chief of the U. S. Bureau of Roads and Col. Mason M. Patrick, Corps of Engineers, U. S. Army, has distinguished men representing the tire and rubber industry, the automotive industry, the American Association of State Highway Officials, engineering schools, and the U S. Bureau of Education.

U. S. FOREST PRODUCTS LABORATORY CELEBRATION

The Forest Products Laboratory of the United States Department of Agriculture and Forest Service held a decennial celebration at Madison Wisconsin, July 22-23. Headquarters were established at Park Hotel, Capital Square, and the general assembly met in the Agricultural Hall, University of Wisconsin, H F. Weiss, chairman.

Important subjects among the papers and discussions included, "Legislative Measures for Forest Conservation," The Honorable Emanuel L. Philip, Governor of Wisconsin; "Translating Knowledge Into Power," E. A. Birge, L. L. D., S. C. D., President of the University of Wisconsin; "The Forest Products Laboratory, C. P. Winslow, Director, Forest Products Laboratory; "What Research Has Accomplished for the Automotive Industry" C. F. Kettering, Chief Engineer, General Motors Company; "Forest and National Prosperity," Lieutenant-Colonel W. B. Greeley, Forester, Forest Service, U. S. Dept. of Agriculture; "Some Problems of the Pulp and Paper Industry" D. C. Everest, Secretary and General Manager, Marathon Paper Mills Company; "America's Place in Industrial Research" H. E. Howe, chairman, Research Extension Division, National Research Council; "Some Problems of the Lumber Industry," F. J. Scanlon, Member of the Forestry Committee, National Lumber Manufacturers' Association.,

A Wood-Using Industries Conference on a National Forestry Policy was held on July 23 at 2:00 P. M. in Argicultural Hall, University of Wisconsin.

A meeting of the Executive Committee of the American Wood Preservers' Association was held on the afternoon of July 22.

Deans of Forestry and Engineering Schools met July 24 to consider a curriculum for Forest Engineers.

There was a meeting of the Interregional Technical Committee of the National Lumber Manufacturers' Association on the morning of July 24.

The Venetian Night Regatta of the University of Wisconsin was held at the foot of Park Street on Lake Mendota on the afternoon and evenings of July 23.

MISSOURI GOOD ROADS FEDERATION

On July 12, a meeting of thirty-five members of the Missouri Good Roads Federation representing the executives and finance committees and the standing committees was held at the office of the Federated Roads Council, St. Louis, and adapted a plan for raising a $100,000 compaign fund to promote the $60,000,000 bond issue for road improvement in Missouri to be voted on in November.

For this purpose, St. Louis will raise $75,000 and Kansas City will raise $50,000; part of the money to be turned over to the state organization and part of it to be used for promotion of city activities. The program includes vigorous advertising and a truck tour through the state.

A general convention of the Missouri Good Roads Federation, including county organizations with a roster of more than 15,000 names, will be held in St. Louis in the latter part of August

AMERICAN MILITARY ENGINEERS

The Buffalo Chapter of the Society of American Military Engineers has been organized and elected Col. Clarke S. Smith, pres., and Captain A. B. Jones, secretary and treasurer.

AMERICAN ASSOCIATION OF ENGINEERS

At the July 15th meeting of the Indianapolis Chapter, the principal subjects considered were the practice of free engineering service by governmental or educational institutions and manufacturing firms, the work of the railway wage boards now sitting at Chicago, the improvements of the local street railway service, and the plans designed by the architects' association for an Indianapolis civic center.

PERSONALS

Springer, E. R., has been appointed chief engineer of the Boston Transit Department.

Davis, E. S., chief engineer of the Boston Transit Dept., has resigned after many years of service for the city.

Donnelly, C. E., has been appointed office engineer for the city planning commission, Kansas City Mo.

Baron, E. V., is in charge of the Priest Rapids Irrigation District, with headquarters at White Bluffs, Wash.

Green, H. P., has been made president of the Herbert Post Green and Associate Inc., archieects, engineers and cost engineers, New York City.

Mooney, B. E., has been appointed city engineer and water commissioner of Whitefish, Mont.

Leighton, M. O., has been organized an engineering firm in Washington, D. C.

Beattie, G. T., is highway engineer for the U. S. Bureau of Public Works at Missoula, Mont.

Lingley, Ralph G., has been elected superintendent of sewers of Worcester, Mass.

Moore, H. J., has been appointed forester of Provincial Highways for Canada, and will have charge of beautifying the roadways by planting shade trees and shrubs.

Blunt, G. A., has been appointed engineer of Dubuque County, Ia.

Mackall, J. N., has been appointed chairman and chief engineer of the State Roads Commission of Maryland.

Dunn, H. L., has been appointed superintendent of street construction, Columbus, Georgia.

Bramhall, I. N., a contractor in Tekamah, Nebr., was killed by a train June 1.

Parmer, Claude, vice-president of the Kuest Contracting Company, Indianapolis, was recently killed by a bridge erection accident at Cincinnati.

Butler, Wm. P., senior highway engineer of the U. S. Bureau of Public Works, and has resigned from that position and has become consulting engineer of the Southern Surety Company in charge of their highway interests.

Earle, D. M., has been appointed city engineer of Worcester, Mass.

Boggs, J. S., has been appointed state highway engineer of Kentucky.

Taylor, P. T., has been made city manager of Grand Haven, Mich.

Kulicka, O. C. and A. E. Boyte have established the Delta Engineering Co., at Greenville, Miss.

McKee, Alfred, has been appointed engineer in charge of bridge construction for Polk County, Ia.

Moultrop, I. E., has been elected by the United Engineering Society as a trustee of the American Society of Mechanical Engineers and a member of Engineering Foundation Board.

Deeds, J. F., of the U. S. Geological Survey, is investigating the irrigation projects along the Musselshell River, Mont.

Scott, T. S., is in charge of road construction work in Brockville, Ont.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Instal'ations

LAKEWOOD ROAD FINISHING MACHINE

A machine for eliminating hand work in finishing concrete roads and pavements has been put on the market by the Lakewood Engineering Company. This installation permits the use of drier, coarser mixtures, removes air and water from the concrete and enables a coarser aggregate to be used than is practicable with hand work.

The machine spreads the concrete as it comes to the mixer to approximately the desired height and crown, tamps and compacts the concrete to the finished height and crown, and floats the surface of the concrete smooth with a belt. In this way the machine enables the work to be done more rapidly and with a smaller force than by hand.

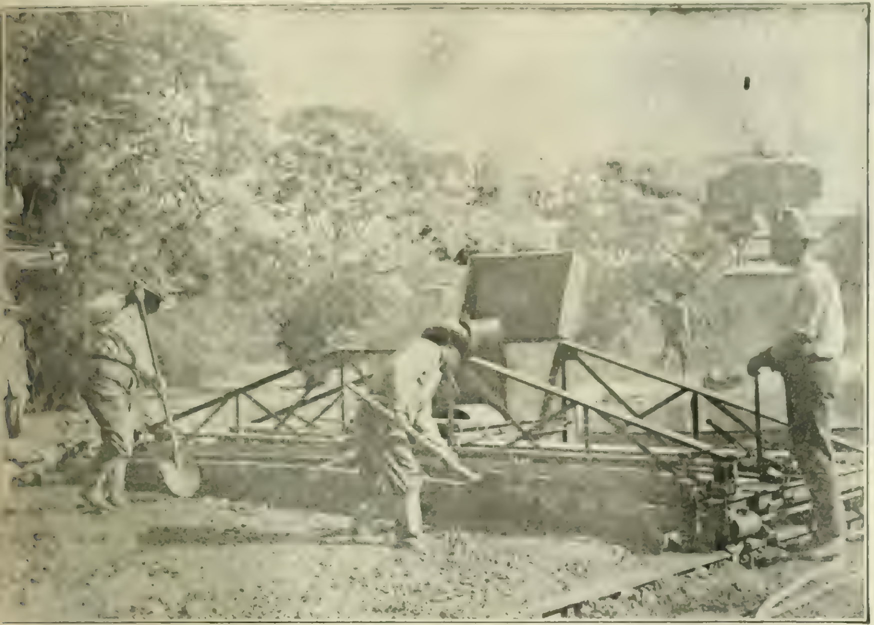
As the machine travels back and forth under its own power, a screed-like element, called the strike-off, spreads the concrete to the approximate height and surface, after which the tamper, located just back of the strike-off, tamps the concrete, the first time over with long hard stroke, the second time with a short rapid stroke, continually agitating the concrete as regulated by the operator.

At the rear of the machine a finishing belt moves slowly across the surface of the concrete to give it a smooth finish, which however, is sometimes omitted in favor of the finish produced by rapid strokes of the tamper that gave a slightly roughened surface and a perfectly true crown.

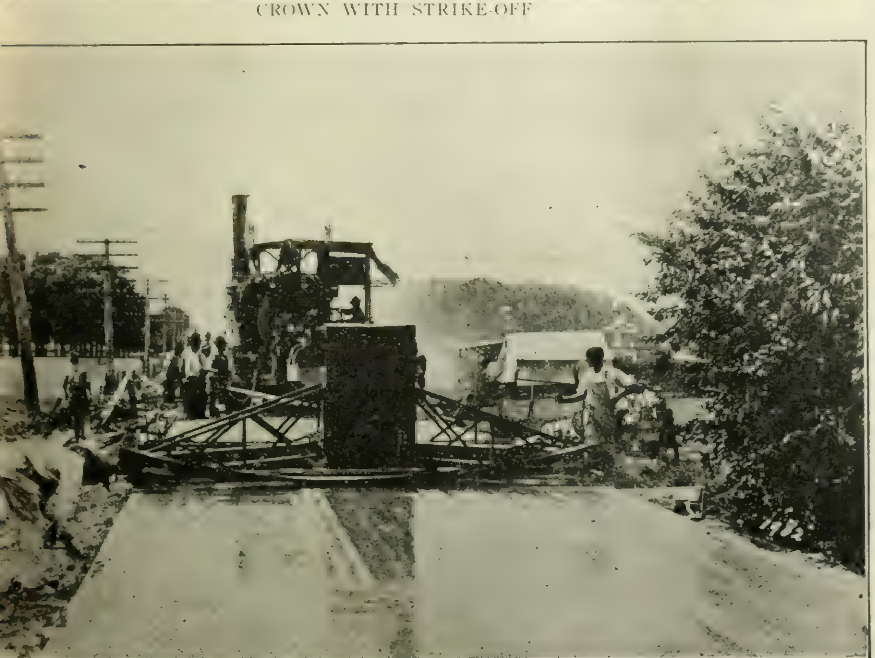
The reduced amount of water and the thorough tamping produce a concrete that is stronger than the handfinish pavement and permit the use of concrete so dry that it can be satisfactorily hauled a considerable distance from a central mixing plant without separation of the aggregate.

The machine can be operated by one man on either side of the road and if he has two helpers with spades, the work can be done better than is ordinarily done by eight or nine men.

The machine was successfully used on about 200 road jobs in the year 1919.



FINISHING MACHINE DRESSING CONCRETE TO APPROXIMATE HEIGHT AND CROWN WITH STRIKE-OFF



SMOOTHING SURFACE OF CEMENT PAVEMENT WITH BELT ATTACHMENT OF FINISHING MACHINE

PURE WATER FOR SWIMMING POOLS

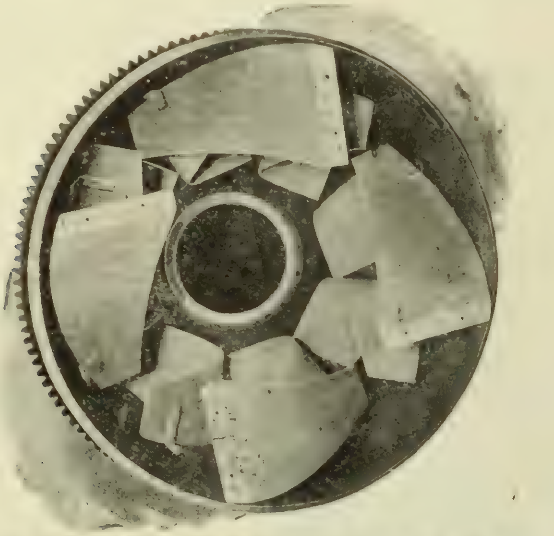
This pamphlet describes the importance of puriffying water in swimming pools and the manner in which it can be reliably and economically performed by use of the Wallace & Tiernan Companys' chlorine control apparatus. The state laws of Florida and of California require a high standard of purity to be maintained for the water of swimming pools which can be secured either by waste and refilling, or by circulation and purification.

If a 50,000-gallon pool be refilled once a week with water costing 5c per 100 gal. the annual cost will probably exceed $1,250. Better results for the same pool are claimed by the use of the chlorine purification process at a daily cost of only 6c for chlorine and a total cost including the interest on the investment, of not more than 30c per day. It is claimed that the same water after being used 6 months with daily purification is often purer than when first admitted to the pool.

The chlorine is sold in liquid form in 10 to 150 pound cylinders and, when released, volatilizes and passing through a pressure compensator is introduced into a solution jar where it is throughly mixed with water and discharged by gravity into the pool. When this method is used, additional water supply is only necessary to compensate for evaporation and waste.

RANSOME STANDARD MIXERS

The Ransome standard mixers, 1920 model, represent the combination of successive developments for 70 years in the uninterrupted succession from the first Ransome and his son, E. L. Ransome, "The father of the concrete mixer industry," to the present Ransome Concrete Machinery Company, which designs and manufactures all kinds of plant and equipment for concrete construction.



MIXING BLADES THAT KNEAD, RUB, AND GRIND THE AGGREGATE

The standard mixers are heavy, and are claimed to be durable and efficient. Their capacities are rated for a wet mixed product made with stone not larger than 1½ inch diameter and 1¼ gallon of water per cubic foot of concrete. The mixer is materially modified in the present 1920 design, commenced in 1918 and thoroughly tested to prove every new detail and insure abundant strength. The truck and frames are very substantial and all of the principal bearings are equipped with Hyatt rollers mounted in ball and socket hangers that insure absolute alignment and eliminate a large amount of friction

The old cast-iron drums are replaced by steel, equipped with extra-heavy steel mixing blades which operate on the principle of grinding, rubbing, contact and forcible kneading of the materials into a homogeneous body—concrete." The special shape and arrangement of the mixer blades enable the machine to handle dry mix which is even more difficult than wet mix.

The drums are provided with high-carbon steel tires forged by drop hammers from a solid billet, rolled, turned and shrunk on, thus giving an efficiency equal to that of locomtive tires and insuring against the flat wearing of other kinds of tracks.

In order to insure the rapid discharge of the dry mixture, the number of blades in the drum has been doubled. The discharge mechanism has been completely redesigned ,and is now modified by the addition of a splash plate to prevent any slopping.

The new hoist drum is of a conical shape with a spiral groove, increasing the life of the hoist rope and providing for an acceleration of hoist speed as the load becomes lighter.

The batch hopper is provided with a vertical sliding gate mounted entirely on the outside of the hopper with the guides so arranged that there is no point at which concrete can lodge and interfere with the operation of the gate.

INDUSTRIAL NOTES

THE INDUSTRIAL CITY OF BLAW-KNOX

About 1,000 persons are employed in the Blaw-Knox shops, most of whom live in Old Hoboken. A petition signed by the people of the town, asking the U. S. Senate to change the postoffice name to Blawnox, has just been granted.

"Blawnox" is the home of Blaw-Knox Co., manufacturers of Blaw Buckets, Blawforms concrete Construction, Knox Water-Cooled Doors and Ports, Prudentian Steel Buildings Transmission Towers, and other structural and plate steel products.

The Blaw-Knox Company first established in Hoboken about five years ago, occupying a comparatively small shop, at the same time operating another plant at Wheatland, Pa. About two years ago the latter plant was removed and added to the Hoboken works. The magnitude of the works has since increased by the erection of a large hammer-welding plant, augmenting the already extensive oxy-aceylene and electric welding facilities of Blaw-Knox Company.

AMERICAN-LA FRANCE FIRE ENGINE COMPANY INCORPORATED

The American-LaFrance Fire Engine Company, Inc., reports June sales of 27 important items of pumping engines, hose carts, combination cars, service trucks and tractors and June shipments of 35 items of similar nature. These have gone to 18 different states and to Canada and Japan.

IOWA ROAD BUILDING COMPANY FORMED

The Iowa Willite Construction Company has been organized by a number of Davenport citizens, with Alfred C. Mueller as president and William Howe as general manager. It is the plan of the company to place some stock in each county of the State. The company will specialize in the construction of pavements and roads, especially that type of road known as "Willite."

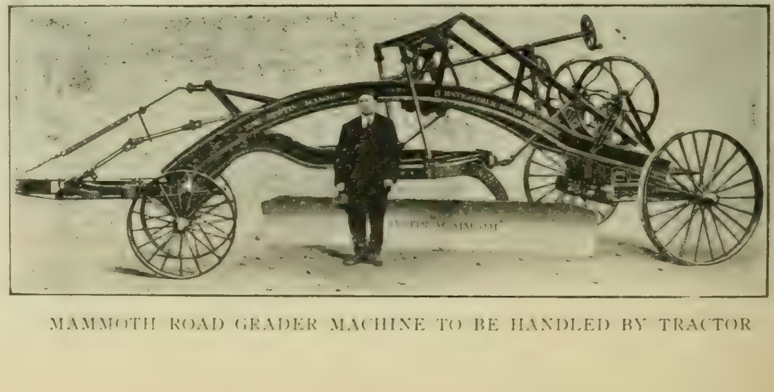
The Keystone Sheet Metal Works, 139 Broome Street, Newark, N. J., have been organized to manufacture sheet metal products. Samuel Kibbel heads the company.

MAMMOTH GRADERS SOLD WHOLESALE

On account of the scarcity and high cost of materials and the difficulty and uncertainty of transportation, the state of Nebraska has modified its highway construction problem and is temporarily devoting a larger part of the new construction to the building of earth roads of a character that can later be transformed into hard surface roads when conditions are more favorable.

To supplement the scarcity of men and plant, the state has purchased for use this season, a consignment of 70 Austin-Western Road Machinery Company's Mammouth graders weighing 6,350 pounds each and having blades 12 feet long. The graders are accompanied by heavy tractors that are available for any kind of hauling when not in service with the graders.

This equipment equals an army of laborers with hundreds of teams and is doing the work more rapidly, satisfactorily and economically than it could be accomplished by hand, while the use of a single type of machine avoids complication, makes both machines and operators interchangeable, reduces first cost and maintenance and establishes a desirable standard.



MAMMOTH ROAD GRADER MACHINE TO BE HANDLED BY TRACTOR

PUBLIC WORKS.
CITY COUNTY STATE
A Combination of "MUNICIPAL JOURNAL AND PUBLIC WORKS" and "CONTRACTING"
Vol. 49 FLORAL PARK, AUGUST 7, 1920 No. 6

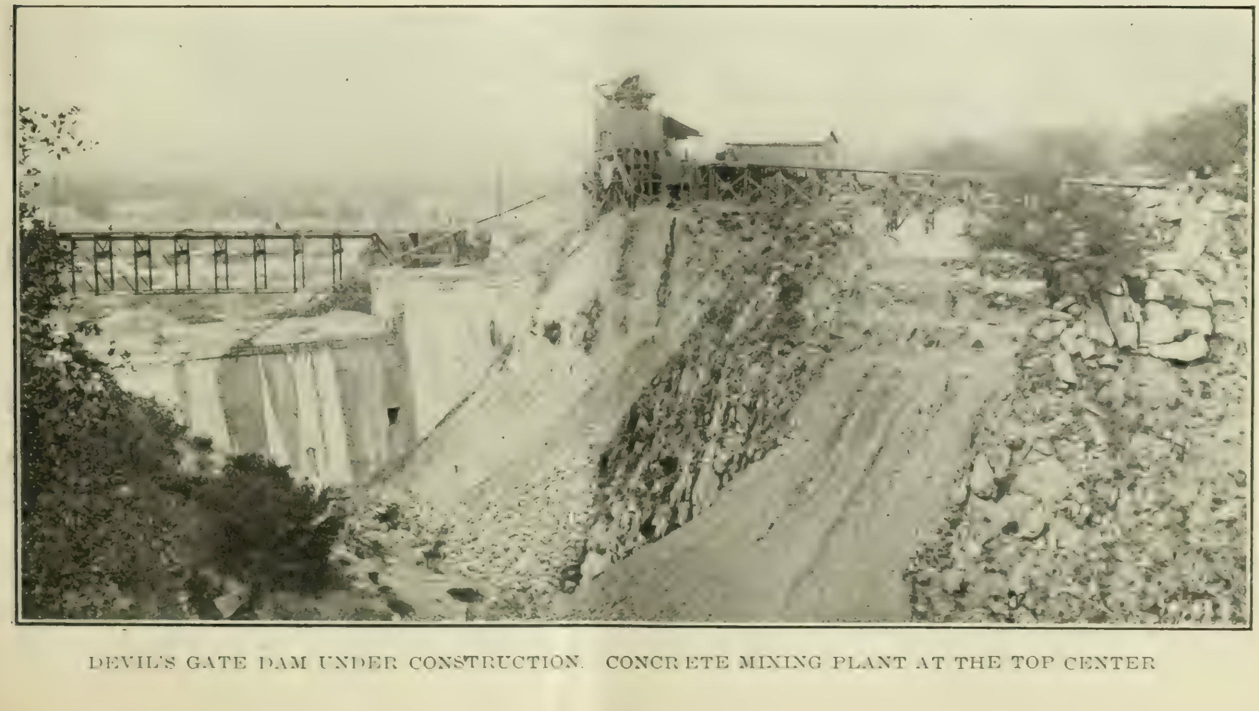
Devil's Gate Dam

Flood control dam built for the Los Angeles County Flood Control District, with a maximum height of 130 feet, in the construction of which not more than twenty-one men were used, thanks to labor-saving machinery and methods.

There has recently been completed near Pasadena, California, a dam known as the Devil's Gate Dam across the Arroyo Seco which will create a reservoir covering about 200 acres. The quantity impounded is not large, but the purpose of the reservoir is not primarily that of storage but rather flood control. The channel of this stream can carry about 7,000 second feet without damage, but when the amount exceeds this there is danger of wash-outs and other injurious effects, and the floods in the stream sometimes reach 11,000 second feet. At such times the dam will hold back the peak flow of the flood, which is of short duration because of the steepness of the water courses and other topographical features of the country. The work is being done for the Los Angeles County Flood Control District, of which J. W. Reagan is chief engineer.

The dam is 310 feet long, its maximum height is about 130 feet, it is 2 feet thick at the top and about 75 feet at the lowest point. In addition there are a driveway and two sidewalks across the top of the dam, which overhang the down-stream face of the dam and are supported by flying buttresses. Along the sidewalks are solid railings with lamp posts at intervals. This roadway carries traffic between Pasadena and Flint Ridge. The entire dam, buttresses, etc., contains about 35,000 cubic yards of concrete. In connection with the dam is a spillway about 100 feet wide and 250 feet long which is paved and walled with concrete. Also there is an outlet tunnel 500 feet long and 14 feet in diameter, driven through the solid rock and lined with reinforced concrete. This outlet is controlled by three 7-foot by 9-foot sluice gates which operate in a gate house. A view of the completed dam was shown on the front cover last week.

Solid rock for the foundation was reached without any deep excavation, being found not



DEVIL'S GATE DAM UNDER CONSTRUCTION. CONCRETE MIXING PLANT AT THE TOP CENTER more than 15 feet below the stream bed. As a consequence, very little water was encountered in the foundation excavations. In doing the excavating, a large derrick with a 90-foot boom was used.

The entire construction is of concrete, the cement for which was furnished by the county. The aggregates were taken from the stream bed above the dam by steam shovel and were hauled by motor trucks up an inclined road and bridge to the mixing plant. This plant was built on the bank at one end of the dam and at such height that it was possible to pour eighty per cent of the concrete in the dam by chute directly from the mixer. The balance of the concrete was carried to place by means of concrete cars.

It will be seen that little hand work was required, the aggregate being loaded by the excavating shovels into trucks which carried it directly to the mixer, while the latter discharged it by chute directly into the dam. Under more common methods of construction work of this kind, a construction gang of about 75 men would have been employed. Owing to the labor-saving devices used by the contractors, Brent Bros. of Los Angeles, there were never more than 21 men on the job at any time.

In addition to the aggregate and the cement which was furnished by the county, about 200,000 lbs. of reinforced steel was used. The total cost of the dam will be something over $200,000 in addition to the cost of the cement.

Some Small Imhoff Tanks

By W. A. Hardenbergh

Plans prepared by state health boards and others for sewage treatment plants for schools and institutions and small communities. Various retention periods and capacities per capita are recommended by different designs and for different sizes. The cost exceeds that of a septic tank, which may or may not be justified by better results.

Within the past three or four years generally, but particularly in North Carolina, where a state law requires that all houses within 300 yards of another residence shall be provided with a sanitary means of sewage or excreta disposal, the question of sewage treatment for homes, small communities, institutions, and the like has become an important matter. This is due as well to the great tendency of the past few years to instal running water wherever possible in homes, etc., as it is to the increased demand for sanitation.

This tendency produces the problem of providing a cheap method of sewage treatment which shall require no care or maintenance in operation, no skilled supervision, and no cost of upkeep. In a general way, the septic tank has done as well, perhaps, as could be expected, for there is no piece of complicated machinery that will run for any long time with no care, maintenance or supervision. The small septic tank has been used in such a variety of ways, installed so often by men entirely ignorant of its principles, and in places where its chances for proper operation were so small, that it is indeed wonderful that its reputation has survived at all. An article in Municipal Journal and Public Works some time ago pointed out the wide divergencies of such authorities as State Boards of Health in relation to the capacity per person of these small tanks.

That near relative of the septic tank, the Imhoff, or two-story settling tank has, within the past few years, come into a great deal of well-merited favor in this country. It is very generally used, now a days, in large and even in fairly small installations, such as at the aviation fields during the war (these were all or nearly all circular installations) and at institutions. It is also being proposed for very much smaller installations, several of which are shown hereafter.

Without entering here into any argument as to the merits of the Imhoff tank over the septic in very small installments, it may be stated that the claims for the former are an effluent non-septic and free from odors, (through this is not a weak point with septics in the ordinary small installation), and a sludge, also free from odor, much easier to handle and useful as a fertilizer.

Essential elements of design of small Imhoff tanks as laid down by Frank in a recent publication of the U. S. Public Health Service (Bulletin No. 101) are: A mean detention period of not less than 4.5 hours, and sludge and scum chamber capacities of not less than 3.5 and 2.5 cubic feet per capita respectively. The various state boards of health do not, as a rule, lay down very rigid specifications. In general, they are very liable to assume that the same principles, quantities and measurements may be followed as in the case of small septics.

Figure 1 shows an Imhoff tank designed by the Illinois State Board of Health to care for the wastes from a household of ten people. Owing to the uneven rate of flow in such small installations, the retention period advised is 5 to 6 hours or about three times the average for larger plants. This tank is one of the deeper of the small designs and calls for a depth of sewage of about 12 feet, while the tank itself is only 3 feet wide and four feet long, inside measurements. The total capacity of the tank is very nearly a thousand gallons, which is much larger then is generally regarded as required for a septic tank to handle the waste of ten people. The cost of this tank in 1916 was set at about $60, which, of course, would not be applicable with 1920 prices.

Figure 2 shows a two-story tank designed by the Ohio State Board of Health, for use by ten people. On the basis of design, sludge will have to be removed about twice a year. This tank is slightly shallower than the tank shown in Figure 1, but slightly larger in perimeter, being 3 feet 8 inches wide and 4 feet 6 inches long. The total depth is 10 feet 3 inches, but the effective depth of sewage is 9 feet 6 inches (average). The cubic capacity of this tank is over a thousand gallons, being somewhat larger than the Illinois tank first shown, as is the retention capacity also. The scum area is amply large, in the neighborhood of 45% of the tank area.

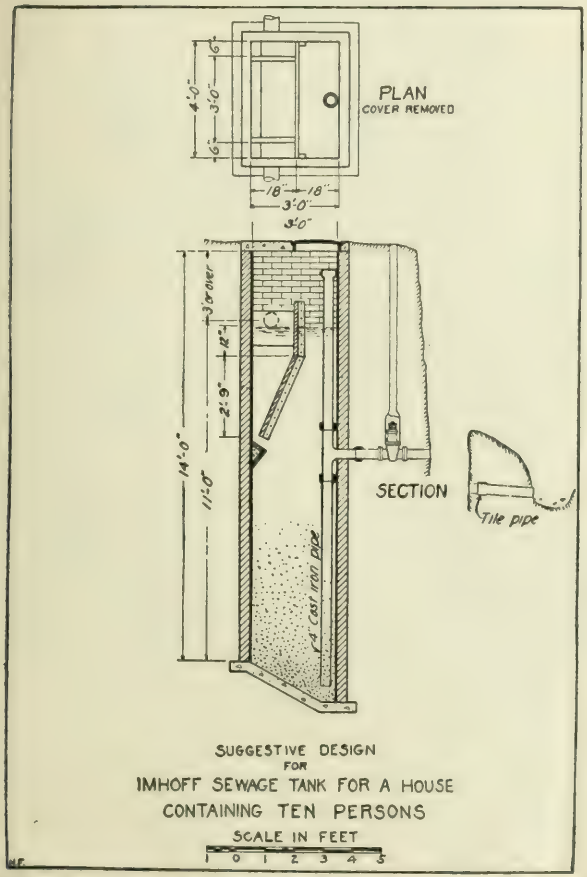


FIG. 1—"TANK ON PRINCIPLE OF EMSCHER TANK, SUITABLE FOR HOUSEHOLD OF TEN PERSONS"

A tank designed by the State Board of Health of Wisconsin is shown in Fig 3. No measurements are given with this design, but the general requirements for tanks in that State are 30 gallons per capita.

The Ohio State Board of Health has also designed a tank for school use. This tank, shown in Figure 4, will care for 250 pupils, the basis of design being a flow of 15 gallons per capita per day. The flow may be passed through either or both chambers. The capacity of the channels is based upon a detention period of 4 hours (2 hours for each channel). The tank will care for 3,750 gallons per day, with total flow occurring

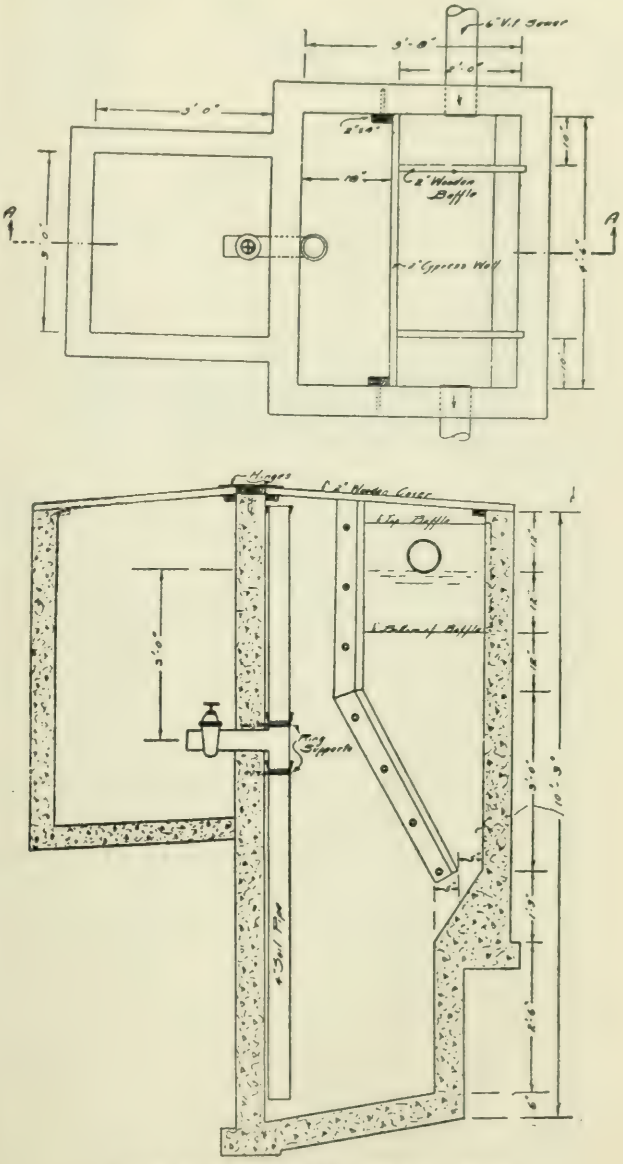
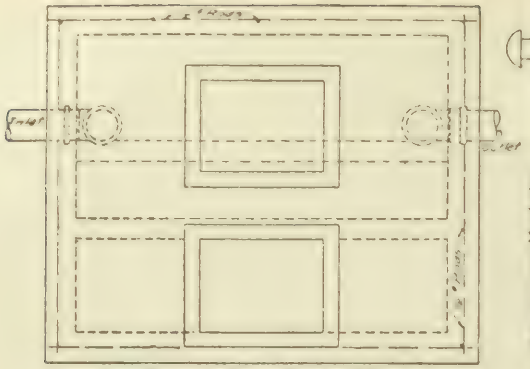
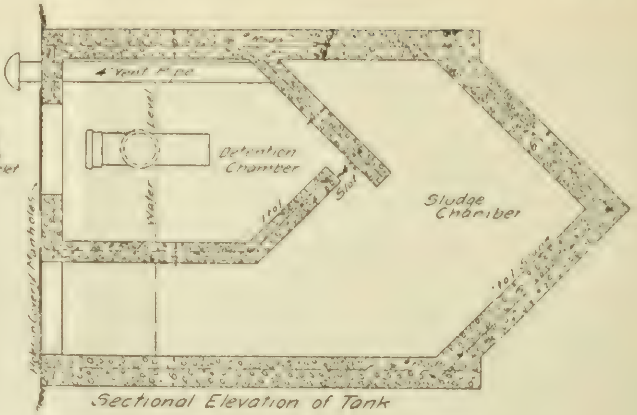


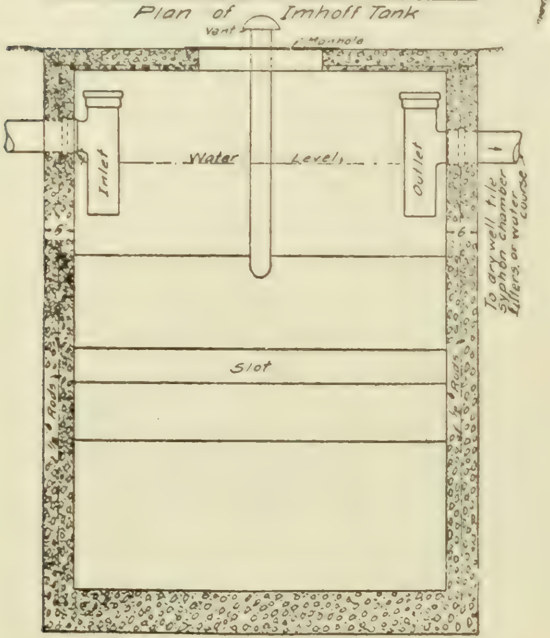
FIG. 2—FOR USE BY TEN PEOPLE
By Ohio State Board of Health.



Plan of Imhoff Tank



Sectional Elevation of Tank



Elevation of Imhoff Tank

FIG. 3—DESIGN OF WISCONSIN STATE BOARD OF HEALTH

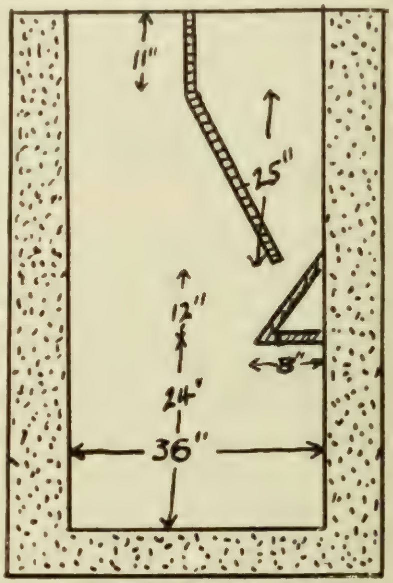


FIG. 5—FOR A FAMILY OF FIVE PERSONS

during the 8-hour school day. Slots and overlap are both 6 inches. The sludge compartment has a sewage capacity of 200 cubic feet, which is estimated to be sufficient for a 9 months accumulation of sludge. The gas vent has an area of about 17% of the tank surface. The depth, extremes, is 12 feet 4 inches. The cubic capacity of the tank is in the neighborhood of 5,000 gallons. As in nearly all the tanks described previously, a sludge discharge pipe is provided.

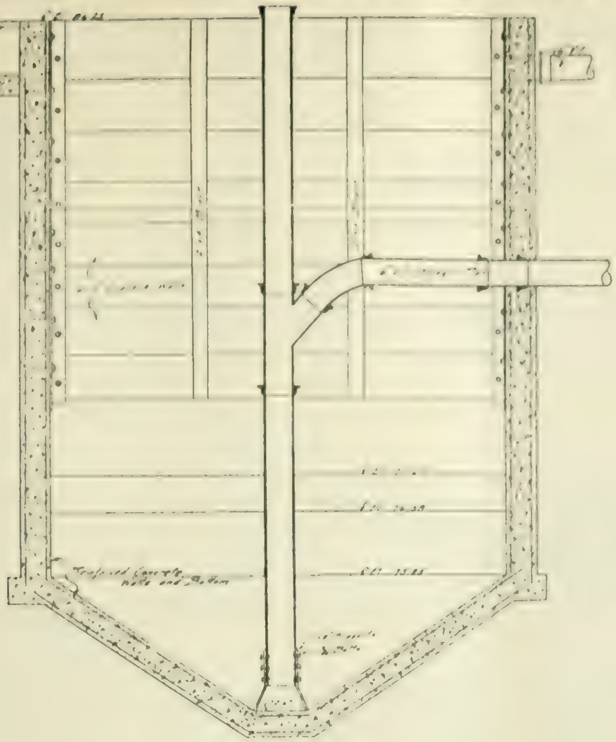
Frank Rhynus in the bulletin previously noted (U. S. P. I. B. No. 101), shows several designs for small Imhoff installations. The tank built to care for a family of five people with a total daily flow of 150 gallons of sewage, calls for a settling chamber capacity of 8 cubic feet, corresponding to a period of 9 to 10 hours, for a sludge chamber capacity of 5 cubic feet per capita, a scum chamber area of 1.2 square feet per person and a scum chamber volume of 3 cubic feet per capita.

The tank is the smallest of any heretofore shown and is 3 by 4 feet in plan and 6 feet deep, with a depth of sewage of 5 feet. Scum boards are placed 12 inches from each end. A section of the tank is shown in Fig. 5. This tank is combined with a dosing chamber and sand filter bed. For a family of 6 persons using 320 gallons per day, the same tank is used but the secondary treatment is varied considerably. This tank has a working capacity of about 450 gallons, which is considerably in excess of the requirements of 5 people, as a rule, with the septic tank. Other designs are shown, worked out for various combinations and sizes, in the bulletin, which was prepared by Frank Rhynus under the direction of Prof. E. B. Phelps.

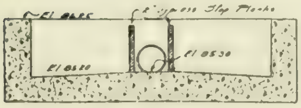
Figures 6, 7, and 8, show some designs for considerably larger installations. Figure 6, which has a depth of sewage of 9 feet 10 inches and a plan of 5 feet 6 inches by 8 feet at the top, 3 feet 6 inches in width at the bottom, was built to care for 150 houses in a mining community. This is a fairly cheap construction. The scum chamber area and volume are ample.

Figure 7 is a plain rectangular tank of more or less standard design. It is built to care for 300 people or 785 school chidren. The depth of sewage is 12 feet 6 inches and the tank is 11 feet square. In the original plan, no sludge discharge pipe is provided in this tank, but it can easily be added.

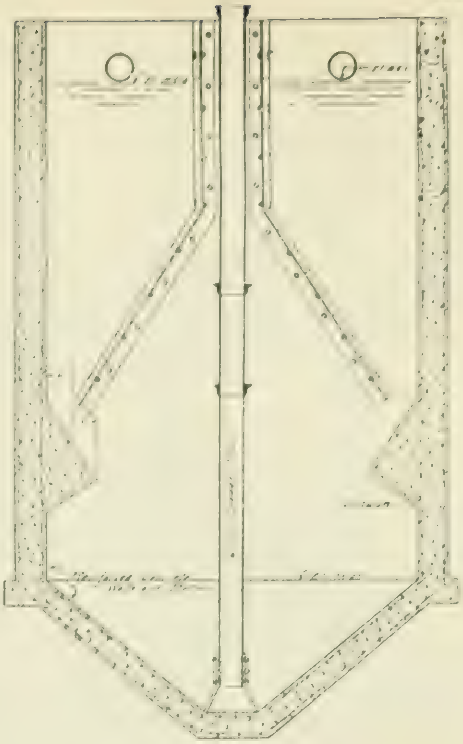
A somewhat peculiar arrangement is shown in



Section on 'CC'



Section 'BB' - Influent Chamber



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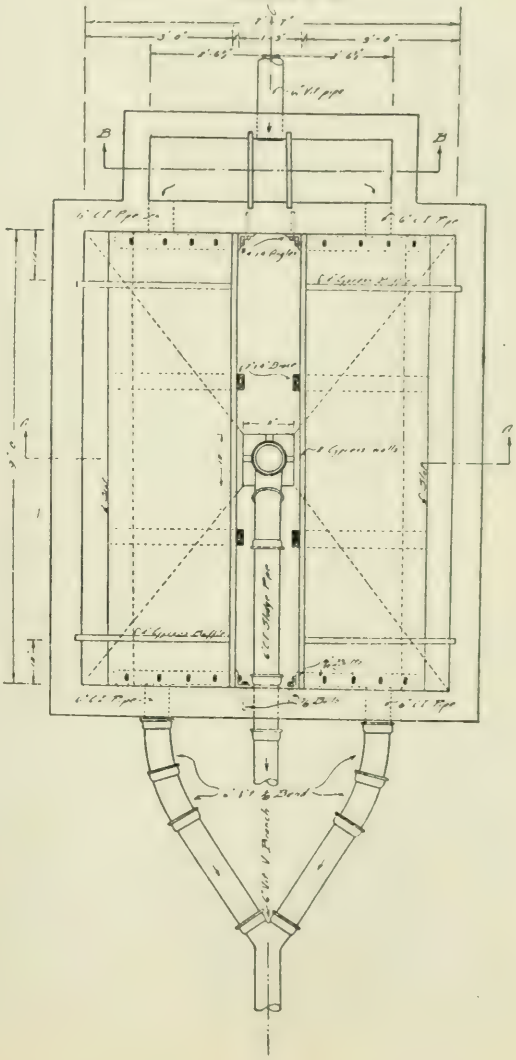

FIG. 4—PLAN AND SECTIONS OF TWO-STORY SETTLING TANK FOR SCHOOL OF 250 PUPILS—OHIO STATE BOARD OF HEALTH

Figure 8, which was built to care for 300 people, the same as tank Figure 7. It is, however, of much less capacity, with an effective depth of less than 11 feet, a width of 7 feet and a length of the same. This design is considered faulty owing to the poor arrangement of the interior, which not only adds to the cost, but may also cause difficulty by the trapping of gas or the forming of a mat under the projecting shelf.

Undoubtedly the small Imhoff tank can be used satisfactorily, even in depths as little as 5 feet, and in such designs as those shown above will produce good effluent and sludge. Neither is there any doubt but that their cost is greater than septics built for equivalent numbers of people or amounts of sewage. It will be noted in every case above that the tank capacity for the 2-story tank is generally 50% to 100% greater than that provided or required for the septics. Extra depth of excavation costs more, also, and concrete work is usually more complicated, which means that the cost per yard will be greater. It will thus generally be a matter to determine locally whether or not the extra cost of Imhoff construction will be balanced by better results in operation for the small plants.

Note: Fig. 6, 7 and 8 will be found on the next page.

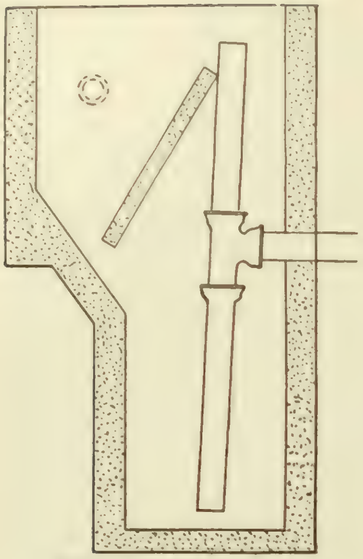

FIG 6—DESIGNED FOR 150 HOUSES IN A MINING COMMUNITY

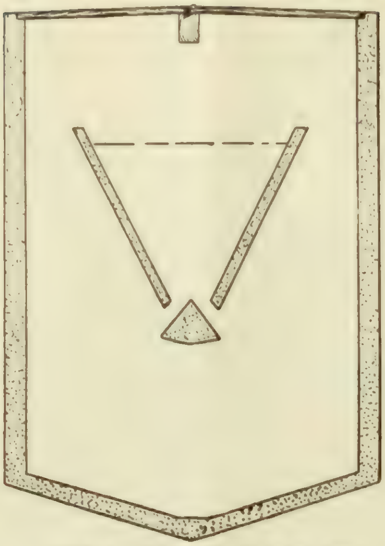

FIG. 7—DESIGNED FOR 300 PEOPLE, OR 785 SCHOOL CHILDREN

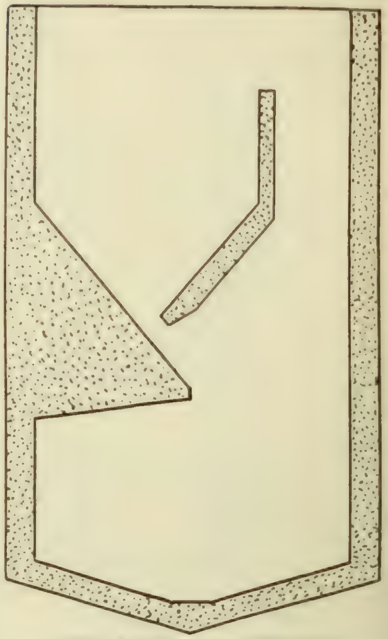

FIG. 8—FOR 300 PEOPLE

Heat Value of Toronto's Sewage Sludge

Investigations have been made by Toronto to determine the heating value of sludge accumulating at the sewage disposal plant, and these indicate that such value is nearly three times that of garbage. A fuel manufacturing company has contracted to purchase the city's garbage, paying $1.00 a ton for the same, and it is hoped that similar arrangements may be made for disposing of the sludge if it is found to have a heat value warranting its use.

The tests are still under way but those so far made indicate that the sludge has an average heating value of 5,600 B. t. u's per pound, as against about 2,000 in the city's garbage. The constituents of the combustible material of the sludge average as follows: Fixed carbon 6.53%; volatile combustible matter 52.85%; ash 40.61%.

Sewer Contractors Abandon Contracts

Several contractors for the construction of sewers for the city of Detroit have abandoned their contracts recently, presumably because the cost of the work is greatly exceeding that which had been estimated by them. The city will hold the guarantee companies responsible for the completion of the contracts. One contract which was abandoned and which the guarantee company was notified to complete was renewed by the original contractor, the Commissioner of Public Works considering this to be to the advantage of the city since it would cost the department about $450,000 to do work which had been let for $276,300, and in addition a law suit would probably be necessary to collect the difference from the surety company.

Typhoid Fever in Dallas

During the past few weeks there has been an epidemic of typhoid fever in Dallas, Texas, but a considerable falling off in new cases was noticeable during the week ending July 17th. The health department, while it has not definitely determined the cause, reports that data so far obtained point to the water from White Rock reservoir. Owing to a break-down at the pumping station which supplies the water to the city regularly, water was turned into the mains from White Rock reservoir for three hours on June 10th without being filtered, although it was chlorinated with 0.4 parts of chlorine per million. The raw water tested 1,000 bacteria per c. c. and after being treated there were still 300 to 400 bacteria, while the city water usually carries only 15 to 30.

Philadelphia's Delaware Bridge Postponed

Although both the mayor and the councilmen of Philadelphia are reported to be in favor of the Delaware river bridge, for which Philadelphia would be expected to pay at least $20,000,000, it seems certain that no definite action will be taken before the council adjourns for the summer.

As explanation of the delay, it is stated that the mayor is unwilling to add this heavy burden to the city taxes until he is satisfied that the population is in favor of it. In addition, he desires that more definite information concerning the plans and cost of the bridge be obtained and has asked the council to appropriate $250,000 to be used by the bridge commission in obtaining the data necessary for determining these points more exactly.

Street Cleaning By Municipal Forces

Conclusions from a study of the subject made for the Philadelphia city council decidedly favor the employment of municipal forces for street cleaning and also for refuse collection. The argument for and against are given, and the recommendations.

"In the case of street cleaning work, the disadvantages of contract performance are so numerous and so overwhelming that the argument of possible increased labor efficiency under contract work is relatively unimportant. Municipal operation is the only proper method, and every effort must be made to overcome any disadvantages inherent to it."

This is the conclusion of a committee of three appointed by the city council of Philadelphia, stated in a report submitted to council July 13th. The committee consisted of Lieut.-Col. E. B. Morden, chief of the Bureau of Street Cleaning; James W. Follin, engineer of the Bureau of Municipal Research; and J. H. Nelson, principal assistant engineer of the Bureau of Highways.

In addition, Col. Morden and Mr. Follin recommended that rubbish and ashes be collected by city forces beginning, January 1, 1921, and Mr. Nelson that such service be postponed for one year longer, and all three agreed that municipal garbage collection should begin next year.

During their two months' study of the subject, the committee visited fifteen of the larger cities of the country and found that none of these clean their streets by contract. Until recently Philadelphia's charter required that city to do this work by contract but, as described in "Public Works" a few weeks ago, the charter adopted last year permits muncipal street cleaning and collection.

The cities visited were New York, Chicago, Detroit, St. Louis, Pittsburgh, Toronto, Canada; Buffalo, Washington, D. C.; Newark, Baltimore, Rochester, N. Y.; Columbus, O.; Worcester, Mass.; New Bedford, Mass., and Trenton, N. J.

The reasons of the committee are summarized as follows:

"It is perfectly clear that no contract is on a sound basis unless, (1) the work to be performed is definitely specified so that the bidder can determine the cost of performance and bid intelligently, and (2) unless it is possible for the party paying for the work to determine if the work specified has been performed. With this statement in mind let us analayze the existing contracts in Philadelphia.

DISADVANTAGES OF EXISTING CONTRACT

"The existing contract for street cleaning is disadvantageous for the following reasons:

"First, It is humanly impossible completely and definitely to specify the work to be performed, for although the frequency of cleaning can be given, standards of cleanliness are not possible of definition, and the results of the street cleaning must be judged without definite specifications, and therefore,

"Second, It is necessary for the bidder to pad the contract price to provide against possible unfriendly attitude on the part of the bureau chief who is the judge of the work performed, and of other officials.

"Third. The contractor is sometimes forced by unfavorable circumstances to attempt to control the city inspection forces, and there is an ever present temptation to influence their reports for a consideration.

"Fourth. Undue authority is given to the bureau chief to judge the results of the work performed, and he is in a position either to make or to break the contractor as he wills.

"Fifth. It is difficult to determine whether the streets are properly cleaned because of the intangible results, and the fact that the streets do not stay clean very long after the cleaners have been over them.

"Sixth. It is difficult to obtain practical and dependable inspectors.

"Seventh. The city is unwilling to pay salaries to the street cleaning inspectors commensurate with the responsibilities involved in work of such an intangible nature, thereby putting a premium upon inefficiency and dishonesty.

"Eighth. It is impossible to guarantee to the contractor that the public as a whole will obey ordinances, thereby throwing the burden of their disobedience on the contractor, who has this indeterminate factor to take into consideration in making his bid.

"Ninth. The contractor is tempted to slight the work by racing his equipment and speeding up his gangs, thereby covering the streets with the specified frequency, but only imperfectly.

"Tenth. It is impossible to obtain flexibility under any form of specifications to permit extensive modifications of performance such as are required by seasonal variations or emergency shifting of forces from one district to another.

"Eleventh. It is necessary for the bidder either to amortize his plant and equipment during the life of the contract, thus adding an excessive amount to the bid, or to insure by some other means that the contract will be renewed and new competition discouraged.

"Twelfth. It is necessary for the contractor to add a high contingent cost to his bid to cover the greatest conceivable advances in the labor and material markets.

"Thirteenth. The cost is increased by dual supervision by contractor and the city.

The report points out that the new city charter, in providing for contracts for more than one year, overcomes the eleventh disadvantage of the present system mentioned.

"However, the other foundamental objections would not be altered by increasing contract term under the existing form of specifications, or even by including the minimum labor force requirements that were eliminated from the specifications two years ago.

ADVANTAGES AND DISADVANTAGES OF MUNICIPAL OPERATIONS

"Municipal operation of street cleaning work overcomes the majority of the objections to the existing contract performance listed above, but naturally has certain inherent disadvantages of its own. The advantages of municipal operation are as follows:

"First, Flexibility of organization, with ability to concentrate the force in emergencies and to revise methods and schedules to meet changing conditions that cannot be foreseen when contracts are let.

"Two. The placing of the city bureau organization on a business-like basis, actually performing the work, and abolishing the rewardless task of attempting to keep the contractor's work under control.

"Three. The substitution for the underpaid and unsatisfactory city street cleaning inspection force with superintendents and foremen who actually direct the work and get results, with actual economy from the abolition of costly dual inspection essential to contract work.

"Fourth. Actual saving of money to the city by eliminating the contingent fund included by the contractor in the bid price to guard against unfriendly or unreasonable action by the bureau chief in enforcing the specifications.

Fifth. Actual saving of money to the city in carrying its own insurance against advances in the labor and material markets for which the bidder may make more than the necessary provision.

"Sixth. Accomplishment of the maximum possible amount of work for the money appropriated by Council, since municipal work is at cost.

"Seventh. Avoidance of nonequitable contracts and possible expensive controversies in the courts.

"Eighth. Possible securing of better co-operation from the public in their care of the highways because of the sympathetic attitude of the public toward municipal work.

"Ninth. Opportunity for continuous study of conditions and for making beneficial changes in equipment and methods.

"Tenth. Direct and absolute control of the working forces.

"Municipal operation is subject to certain disadvantages which can be successfully overcome:

"First. The present inability to obtain experienced and properly qualified employes with dispatch through the Civil Service Commission.

"Second. The possible failure of the proper authorities to appreciate the need of sufficient funds to carry on the work and maintain the equipment, which might cause the service rendered to the public to be unsatisfactory.

"Third. Possible decreased efficiency of the labor because the foremen-supervisors are not actuated by the incentive of increased profits which exists in contract performance.

ADVANTAGES AND DISADVANTAGES OF CONTRACT WORK

"Contact work has certain inherent advantages:

"First. The contractor is able to purchase equipment and materials directly on the basis of practical judgment and without the competive bidding in force in the city, thus saving delays and securing the most desirable equipment and materials.

"Second. The contractor is able to compensate supervising employes properly and to increase their salaries immediately to keep them from accepting more lucrative positions and, besides, can offer them special inducements.

"Third. The contractor can regulate wages and salaries without the complicated procedure required in municipal work.

"Fourth. The contractor can hire and discharge employes without restriction or regulation, such as civil service control.

"In the case of street-cleaning work, the disadvantages of contract performances are so numerous and so overwhelming that the argument of possible increased labor efficiency under contract work is relatively unimportant. Municipal operation is the only proper method, and every effort must be made to overcome any disadvantages inherent to it. Civil service control should be reasonable and not arbitrary; the city purchasing agent should cooperate to secure the most desirable equipment and materials and not merely the cheapest price, and the salaries of supervisors and foremen must be fixed equal to those prevalent in outside employment."

The report says that in the cities visited paving conditions were found to be "only fair," and that streets are not maintained as they should be.

"By comparison," the report continues, "the pavements in Philadelphia are probably in a less satisfactory condition than those in the majority of cities visited. Since good pavements are necessary in order to thoroughly clean the streets, the importance of putting the pavements in good repair cannot be overestimated."

GARBAGE DISPOSAL

Taking up the matter of the disposal of garbage, the report points out that a large number of cities are using pigs to consume this refuse. Hog feeding, according to the report, is the "most profitable of any of the methods of disposing of garbage if operated on a scientific basis with proper co-operation from the garbage collection service." The report states that health officers and residents near to piggeries sometimes object, but these objections, according to the experts, are often groundless. Piggeries properly kept do not become a nuisance.

All officials interviewed by the experts laid stress on the necessity of proper legislation requiring the public to place refuse in proper receptacles and preventing the littering of the streets. In several cities district superintendents are made special policemen with power to arrest. In others a number of regular patrolmen are assigned to this work.

RECOMMENDATIONS MADE

The recommendations made were:

"First. That street cleaning in the entire city be conducted by municipal forces in the year 1921.

"Second. That ashes and rubbish be collected by municipal forces in the year 1921.

"Third. That garbage collection be conducted by municipal forces in 1921, provided that proper bids can be obtained for the disposal of garbage as separate from its collection.

"Fourth. That bids be asked before August 1 for the disposal of garbage from each of the nine street cleaning districts, on alternate bases of one and five year contracts at a ton price rate, the contractor to bid on one or more districts, and to specify the method of disposal to be used and the points where the garbage will be received, the city reserving the right to award one or more contracts for disposal in accordance with the most advantageous plan to the city as a whole.

"Fifth. That rubbish be disposed of according to the present method until steps can be taken toward the erection of utilization plants, to be operated on either contract or municipal basis as may then be found most advantageous.

"Sixth. That immediate steps be taken to determine the practicability and costs of the purchase of the existing plants and equipment used by the present contractors, or of such other plants and equipment as might be available, and also the basis upon which such plants and equipment can be leased if purchase is inadvisable.

"Seventh. That provision be made at once for the expansion of the organization of the Bureau of Street Cleaning to include adaquate engineering personnel to study continuously and to plan improvements in methods of doing work, and such other personnel as is requisite to carry on an intensive continuous educational and law-enforcement campaign.

"Eighth. And, finally, that the 1921 State Legislature be requested to enact new legislation to re-enforce and improve existing laws which regulate the littering of the streets and require the placing of refuse in specified types of receptacles."

Thousand-Foot Piers for Weehawken

The Cunard Steamship Company plans to construct one of the largest shipping terminals in the world on the Weehawken water-front at the cost of approximately $40,000,000 and has asked the approval of the New Jersey State Board of Commerce and Navigation. The company has acquired the rights conveyed to the Delaware and Hudson Canal Company by New Jersey in 1879 and the conversion of this lease into a grant in 1886. The company owns about 4,000 feet of shore front, between the West Shore Railroad on the north and the Erie Terminal on the south. Its plans include the construction of eight 1,000 foot piers.

Traffic Tunnel for Duluth

The City Commission of Duluth is considering the construction of a tunnel from the main land under the canal to the Park Point for handling passenger, vehicle, street railway and freight railway traffic. Such a tunnel has been advocated for many years, but with the rapidly increasing traffic over the aerial bridge the time seems rapidly approaching when the tunnel will be a necessity. While no definite plans have been made, it is suggested that it be a duplicate tunnel with sufficient capacity to handle the various kinds of traffic above named.

The aerial bridge across the canal was built in 1904 and was not intended for the heavy traffic which now uses it. Its original cost was $100,000 and during the 14 years of its existence, maintenance alone has totaled $178,000, that for last year having been $15,000. It was originally intended to permit traffic across the bridge at intervals of 20 minutes during rush hours and 30 minutes at other times, but the interval has had to be shortened and the bridge is no longer capable of handling all the traffic which wishes to use it.

Bus Lines or Street Railways

Street railway companies in several eastern cities are threatening to stop service and surrender franchises if motor buses are allowed to operate on streets used by them. One has actually done so.

The use of motor buses as public conveyances in city and interurban traffic has increased greatly during the past two years, and this increase has naturally aroused the antagonism of the street railways where it has been in direct competition with them.

In a recent discussion of the subject John H. Pardee, president of the American Electric Railways Association, states: "Those cities in which unrestricted jitney competition is now permitted must, in my opinion, soon make a similar choice (between street railways and jitneys.) I do not believe the electric railway can hamper the development of the motor vehicle. I do not believe that it should do so if it could. I do believe, however, that the motor vehicle has no greater rights than the electric car and that it should not, and ultimately will not, on its part be permitted to interfere with electric railway development."

As furnishing a tentative solution of the transportation problem for newly grown suburbs or other sections of the city where the traffic does not yet warrant the great expense of road bed and trolley cars, there probably will be few to question the service rendered by buses, whether regular 20 to 40 passenger bus built for this purpose or the touring jitney. The question is, whether cities should permit such vehicles to compete directly with street railways by paralleling their routes. There is undoubtedly considerable truth in the claim of the railways that such competition may reach the point where it will render operation of the railways unprofitable and that the latter will therefore go out of business, leaving the entire traffic to be handled by the buses. Cities should therefore consider carefully whether the bus service would be as satisfactory to them as the present street railway service, and if not, whether they should not cooperate with the street railways in preventing the competition which will ultimately eliminate them.

The buses operate under the great advantage that they are not required to spend enormous sums for construction and maintaining road bed, and the further advantage that they can change all or any part of their route at any time without any financial loss. Not only are they relieved of the cost of constructing an expensive road bed, but they use, without any cost to themselves except a fee which is generally ridiculously inadequate, the city pavements which are paid for by the taxpayers but which they do an appreciable amount toward destroying.

In the northern part of New Jersey, in New York's metropolitan district, motor buses and jitneys are found by the thousands, and, as noted in Public Works a few weeks ago, the Public Service Corporation, which operates the trolley lines through this section, has appealed to the courts to prevent the competition of these buses.

The subject is being considered by city officials of Toronto, and the Bureau of Municipal Research of that city has endeavored to obtain some information concerning the operation of motor buses in American cities. It obtained information from Chicago, New York, Detroit, Los Angeles and nine other cities in different parts of the country which have had such buses in operation for from thirteen days in the case of Detroit to thirteen years in the case of New York, most of them from two to six years. These charge a five-cent fare in Akron, Huntington, Houston, Kansas City, Los Angeles, San Francisco and Toledo, and 10 cents in Chicago, Detroit, New York and part of Kansas City. In Los Angeles the fares run up as high as 20 cents and as low 3 cents. The capacities of the buses vary from 5 in Houston to 48 in Detroit, the latter being double decked.

The Bureau could obtain only a few figures on operating cost. In San Francisco the operating cost is reported as 23.6 cents per bus mile, while the return on a 5-cent fare yields only a little over half this. In Akron the buses are operated by the Goodyear Company without any intention of making any profit and charge a 5-cent fare for a run of from one to three miles, while the cost is found to be about 4 1-6 cents per passenger.

Striking Trolley Companies

A number of street railway companies have recently been enforcing their demands for permission to charge higher rates of fare by assertions that if such privelege be not granted to them they will discontinue operation altogether, since their income will not permit continuance of service. The demands of a number of companies have become more insistent with the recent rapid growth of jitney service in the East, and several companies have threatened that unless the municipal authorities prevent direct competition with their lines by jitneys or motor buses, they will discontinue service.

Among these was the Connecticut Company of Bridgeport, Conn. Such plea having been made by it, the matter was investigated by the Bridgeport Chamber of Commerce, and a general meeting of the chamber was held on July 12, when every member was given an opportunity to speak or to question any other speaker, the only limit being one of time. The president of the railway company and the president of the Bus Owners Association presented their sides of the question and the discussion was opened by Walter S. Jackson, a street transportation engineer, who had spent several weeks in Bridgeport making a survey of the problem.

Following this meeting, a referendum form was mailed to the members of the Chamber of Commerce and they voted overwhelmingly for limiting jitney and motor bus competition to streets not served by trolley lines. This is interpreted to mean that the majority of the merchants of the city believe that "the trolley furnishes the best available means for adequate, regular, responsible and regulated street transportation," and that jitney service should be confined to streets not served by trolleys.

In spite of this action, the immediate competition of jitneys with trolley lines was allowed to continue, and about ten days after the meeting the trolley company discontinued service, thus giving the motor bus owners an opportunity to demonstrate whether or not they can meet all of the rapid transit requirements of the city. At this writing the trolleys are still out of service and the bus companies have greatly increased the number of buses in service. It is too early yet to decide to what extent the buses can meet the traffic requirements of the city, until both they and the travelling public have become accustomed to new conditions.

Municipal Water Supply for Huntington

A citizens Association of Huntington, L. I., known as the Huntington Association, is considering the construction of a muncipal water supply system to include not only Huntington but also Cold Spring Harbor and possibly other communities, to form a water district.

The Huntington Water Works Company is now operating under a thirty-year franchise which expires next January. The proposed district would comprise a territory having about 11,000 population and an assessed valuation of $10,000,000.

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Imhoff Tanks for Institutions

The number of sewage treatment plants installed in connection with small communities and institutions is increasing and is likely to continue to do so. In several of the states such plants are required to be constructed for school houses where these are not along the line of a sewer, while state and country institutions which are not located in sewered cities are provided with these methods of disposing of their sewage. Such plants are affected by conditions peculiarly their own and these should be kept in mind when designing them. In the case of large institutions there is ordinarily a superintendent who will have charge of the plant and who presumably is more intelligent than the men generally placed in charge of similar plants in small cities and villages, and the desirability of making the plants almost automatic and fool proof is therefore not so great. In the case of country schools, however, it may be that the plant receives practically no attention except occasional visits by inspectors of the State Board of Health.

On another page of this issue a number of plans for tanks to be used for schools and institutions are shown and discussed by a engineer who formerly was connected with the U. S. Public Health Service, these being all of the two-story or Imhoff type of tank. Experience with the operation of these tanks in cities of moderate size and under intelligent supervision has shown that if they are to operate successfully they must be watched carefully and considerable intelligence and experience drawn upon by the operator if foaming and other troubles are to be avoided. It would therefore seem to us that this type of tank is not well adapted to country schools although it may give good service in an institution where it is under the immedate observaton of a superintendent who is interested in having it rendering good service. Even an interested superintendent, however, may find it beyond his ability to prevent or correct the various difficulties of operation which may arise.

The author of the article referred to states that he has found the well known septic tank to be operating with success under conditions which would seem to offer every opportunity for failure, and this type of tank would appear to be as nearly fool proof as any sewage treatment device could be expected to be. It would therefore seem that he would be warranted in holding the opinion which he seems to imply that he entertains, that the septic tank should be used in preference to the Imhoff tank for these small installations unless where a careful study of all the conditions indicates that the results by the Imhoff tank are to be preferred to those securable from the septic tank in spite of these objections. He finds that, if operated with reasonable care, there is no considrable odor from either of them, and the most prominent feature commending the Imhoff tank is the greater adaptability of the sludge to use as a fertilizer, while the most serious arguments against it would apear to be its greater cost and the more expert operation required.

Freight Rates and Road Construction

The construction season for highways is just about half over, and from almost all sections of the country the report comes that the anticipated amount of construction has been reduced by 50 to 75 per cent by the inability of the contractors to obtain materials, chiefly because of the inability of the railroads to transport them. It is true that certain materials such as cement cannot be furnished by the manufacturers in the quantities desired and many contractors have been held up for weeks at a time because of this rather than failure of the railroads to deliver it; but it is probable that, were the mills able to provide it as rapidly as it was desired, it would be found that the lack of railroad transportation facilities would interfere to limit the deliveries.

Freight rates are higher than in previous years and this of course adds to the cost of the materials delivered on the job, but little is said about this. The question arises whether the increase in freight rates which was authorized a few days ago, amounting to from 20 to 40 per cent in different classes of material, will have any effect upon the material situation in connection with road construction. Considering that the high rates already existing do not apear to have retarded construction at all, and that, of the three elements of labor, material and funds required for road construction, the last is the only one which has not given concern in a great majority of cases, it does not seem probable that the increase in freight rates will materially affect the highway situation, at least until the problems of labor and production of material have been solved.

The purpose of the increase is to permit the railroads to add to and improve their equipment so that they may be able to handle the freight which is now practically under embargo, but it will be imposible for such improvement to show any effect before the next construction season begins. Consequently highway officials and contractors will not expect to notice any improvement this year in the material transportation situation; unless, as has been suspected by some, the railroads have so handled the situation as to make it appear much worse than it need have been and, now that they have obtained their purpose of securing an increase in rates, will make a more honest and determined effort to relieve the transportation situation.

It is to be hoped that, either because of this or consequent upon the relieving of the coal shortage in the northwest and northeast, more cars now used for hauling coal will soon be available for transporting stone, gravel, cement, asphalt and other road construction materials, and the rate of highway construction during the next three or four months may be increased considerably over that which could be obtained during the first half of the construction season; and that next year this one of the problems facing all those concerned in highway construction will have been removed or largely ameliorated. This will leave, as factors deciding the amount of work which can be done, the amount of labor and of material available; and the indications are that by winter the situation in connection with both of these also will have improved considerably.

Improved Method for Difficult Pile Driving

In the installation of piles, both for foundations and for sheeting, two important, and often very difficult and costly essentials are driving through hard or obstructed materials and the completion of the installation without injury to the piles.

Where hard impact driving is required, all types of piles are liable to injury, sometimes too great to permit their installation by ordinary methods. Precast concrete piles of the usual design are not generally considered suitable for prolonged heavy driving and are especially liable to be seriously damaged or destroyed by such operations carried on in the usual manner, and when those or other kinds of piles are driven to refusal under adverse conditions there is likely to be warranted distrust of their integrity, even if the visible portions are apparently not seriously damaged.

These difficulties and uncertainties can sometimes be largely eliminated by the design and method used in the demonstration described in this issue, —— where a rational principle, not commonly applied in such work, was found very successful with precast concrete piles. These instead of being subjected to severe impact, compression, column stresses and possible eccentric or bending stresses and injury by mashing the pile top, were pulled down after the pilot shoe and relieved of practically all installation stresses except tension, which they were specially designed to resist.

The new features would seem to be capable of wide development and modification, and applicable to concrete, wood and steel piles of many kinds and any dimensions, and are pertinent to a wide range of important construction work.

Rates for Electric Power in Eugene, Ore.

The general superintendent of the Water Board of Eugene, Oregon, in a letter dated July 27th calls our attention to the fact that, in the table of "Prices in 1914 and now" in the June 12th issue, the rate for electric current for power in Eugene is given as 9 cents per kw. h. instead of 0.9, which it should have been We are sorry that this typographical error was not detected, and make this correction at the earliest possible date.

Cleaning Philadelphia's Streets

On another page of this issue we give an abstract of the report of a committee of engineers appointed to study the subject of municipal vs. contract cleaning of streets and collecting of refuse in Philadelphia. Those in favor of municipal cleaning are considerably exercised by the fact that the mayor and council appear to be making no effort to prepare for taking over the street cleaning by the first of next year, although it is admitted by all that to do so will involve a very considerable amount of preparation. In fact, the mayor appears to be hesitating for the very reason that he questions the ability of the city to undertake the work on only five months' notice. The Bureau of Municipal Research of the city, under date of July 29, publishes a protest against the delay. After calling attention to the requirements of the new charter that the mayor inaugurate street cleaning by January 1, 1921, unless contract operation be authorized by a vote of eleven councilmen and the approval ot the mayor, and that therefore, unless both mayor and council take such action, municipal cleaning will automatically become the only legal method at the end of this year, the bulletin of the Bureau concludes as follows:

"Certain definite things are essential to starting municipal street cleaning in 1921: Plant and equipment, a labor organization, an administrative or directing bureau staff and adequate operating funds. Plant and equipment involve a capital outlay which cannot be made available from a popular loan at the November election in time to be of use, but the amount necessary however lies within the remaining borrowing capacity of council.

"The development of a labor organization will present many difficulties, it is true, and while future conditions may be uncertain, the city can much better afford to take a chance on adverse labor conditions than can the individual contractors who will charge the city for the chance which they must take.

"Reorganization of the street cleaning bureau is necessary to provide engineering personnel, supervisors and foremen to handle the labor force, but this change will not increase the office payroll because the present inspectors will be no longer needed.

"Operating funds in the 1921 budget probably will not exceed the 1920 appropriations unless labor and material prices increase, but in this event contract prices would also be higher for 1921. After all, the citizens are ready to go the limit of expense if clean streets can be obtained by municipal work."

Road Improvements in Burlington County New Jersey

Converting 60 miles of macadam to sheet asphalt surface. Original width increased and new shoulders built. Binder and top courses mixed at contractor's central plant and hauled maximum distance of 10 miles.

Burlington county, in the west central part of New Jersey, is about 25 miles wide and 60 miles long, reaching to the Delaware river. The soil is in general sandy and loamy, well cultivated, with flat and rolling surface. There is in the county a total of about 1,000 miles of dirt roads and 250 miles of improved roads.

About 60 miles of the macadam roads are being converted to sheet asphalt surface, of which 20 miles was contracted for and completed during last year at a cost of $20,000 per mile, and 20 miles more are being laid during the present season at a cost of about $30,000 per mile, and it is planned to lay the remaining 20 miles during next season.

This year the unit price for top course is about $1.65 per square yard, and widening and resurfacing the foundation, $1.35. In most cases the top course is laid directly on the top of the old waterbound macadam after the latter has been carefully prepared.

In a few cases where the land is very flat and low and the drainage is difficult, the macadam foundation has been replaced by a few thousand feet of concrete base in which, where there is a trolley track, patent angle-iron paving guards are laid on both sides of the track and give excellent satisfaction.

MOORESTOWN—MT. HOLLY ROAD

The road from Moorestown to Mt. Holly, 36,950 feet long, has a 66-foot right of way, and has a paved width of 18 feet with a foundation from 6 to 14 inches thick and a new surface 3 inches thick.

The work is being done according to the designs of and under the supervision of James Logan, engineer of Burlington county. The contract is being executed by the Union Paving Company, of Philadelphia, and includes furnishing 11,193 tons of broken stone and furnishing and placing 75,000 square yards of sheet asphalt surface, besides incidental work, at a total contract price of $160,000.

The original macadam surface being only 12 to 14 feet wide, it required an extension of 3 to 2 feet on each side, which was made by digging trenches 6 inches below the finished grade of the road, rolling or compacting the bottom of the trench when necessary, and depositing thereon 2½ inch broken stone, rolling it and covering with binder.

The macadam surface is scarified from 2 to 3 inches deep by a steam pressure scarifyer attached to the road roller, and the loosened surface is harrowed until all the stone has been cleaned. All depressions are filled with 1½-inch broken stone and the surface is crowned by handwork or by a road grader, and rolled to a solid uniform surface.

A 1½ to 4-inch layer of 1½-inch broken stone is carefully spread and thoroughly rolled with a 10-ton three-wheel roller, is then covered with local gravel and a top dressing of stone screenings in equal parts, sprinkled and rolled to a hard, smooth, uniform surface under a uniform pressure of not less than 400 pounds per lineal inch of roller. The rolling is done from beyond the side lines transversely to the center of the road. A shoulder 6 feet wide is built of material excavated from the trenches, and thoroughly rolled, and the full width from gutter to gutter is scraped.

The contractor usually had work in progress on two or three sections of the road simultaneously, at each of which traffic was diverted for a length of 2,000 to 3,000 feet. In each section there were at all times short lengths of road in every condition, from the scarified macadam to the finished surface nearly ready for traffic.

After a given length, usually about 1,000 feet, of road had been widened and resurfaced as already rescribed, it was opened to traffic for at least one month, to wear down the fine material on the surface and expose the larger stone. It was then swept with machines and by hand with splint brooms, and all depressions filled with 1½-inch stone bonded into position by thorough rolling.

On the well-cleaned surface there was spread a binder course applied at a temperature of 240 to 325 degrees F., according to the temperature of the atmosphere and the condition of the binder. The binder was spread with hot shovels, raked, and rolled to a thickness of 1½ inches with a smooth and regular surface parallel to the finished surface of the pavement. The rapidity of rolling was limited by the specifications to 150 square yards per hour for each 10-ton roller.

As soon as possible after the completion of the binder course, the top course was deposited on it at a temperature of 230 to 350 degrees, according to atmospheric conditions and character of materials, and was shoveled, raked and rolled like the binder, a strip 12 inches wide adjacent to each curb being covered with hot

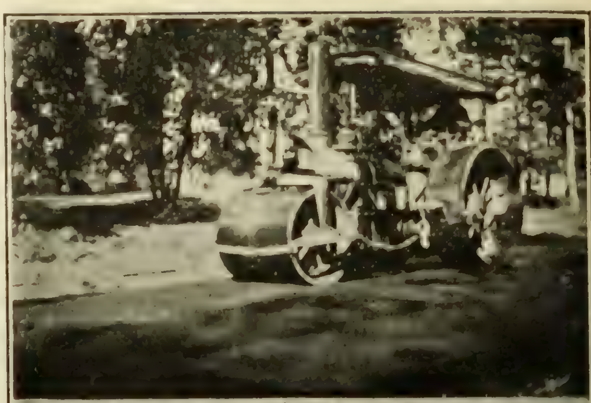
ROLLING BINDER COURSE

BINDER COURSE

DUMPING HOT ASPHALT

RAKING HOT ASPHALT

BUILDING IMPROVED SURFACE ON OLD FOUNDATION



ROLLING TOP COURSE

SMOOTHING TOP COURSE

SWEEPING CEMENT ON ASPHALT SURFACE

FINISHING THE WEARING SURFACE

asphalt cement and ironed with hot smoothing irons when required.

With a total force, exclusive of the men employed at the central asphalt plant, of about twenty men, the work was executed at an average rate of about 1,800 square yards of finished pavement per working day.

RIVER ROAD

The river road at Riverton, N. J., is being resurfaced for a width of 28 feet and a length of about 6 miles, replacing an oiled surface macadam road 18 feet wide, the extra 10 feet in width of the new road being paid for by the borough, while the county pays for the standard 18 feet of width. In general the work is being executed by the Union Paving Co. as contractor in the same manner as the Mt. Holly Moorestown Road.

The surface is first loosened to the depth of the oil treatment by a scarifier, the waste material is removed by a scraper also drawn by the roller, and the road is again scarified, harrowed, scraped, and crowned 4 inches with a layer of 2½-inch stone covered with gravel binder and rolled. A 1-inch layer of screenings is spread over the surface, puddled and rolled until solid, after which the road is opened to traffic for 30 days and the binder and top courses applied in the standard manner.

The binder and top course are hauled 10 miles from the central mixing plant and the top course is, in this case, made so stiff with stone dust that it has developed a tendency to stick in the truck's body, making it difficult to dump it. It was, therefore often necessary to repeatedly back the truck violently against a bumping log in order to jar the asphaltic material out and distribute it over about 50 linear feet of road for each truck load.

MAINTENANCE

These two examples illustrate the general method of resurfacing the Burlington county roads, all of which is done by contract. The maintenance is done by the county forces, which operate three repair units, each consisting of a 1½-ton Ford truck chassis with a 2½-ton steel dump body, used for hauling broken stone, binder and top course required for patching and repairs, as well as for the maintenance of surface-treated and macadam roads. These trucks, which cost only $1,180, can be run at a speed of 20 miles and do as much or more work as effectively as the $6,500 5-ton trucks that run much more slowly. The binder and top-course material is purchased by the county from the contractor's central plant, where it is delivered to the county trucks at a price of $8.50 per ton—considerably cheaper than it could be mixed by the county.

Road stone is broken in crushers, transported by rail and unloaded by a Byers auto-crane to portable storage bins, from which it is loaded by gravity to trucks and wagons for distribution for maintenance work and for the construction of road shoulders.

The county maintains a 600-gallon tank on an auto chassis, with pressure equipment for applying liquid asphalt for the surface treatment of macadam roads. It is planned to provide, next winter, units of Champion snow plows and trucks sufficient to remove, within 24 hours after it falls, all snow from a width of 18 feet on the 60 miles of asphalt-surface roads in the county.

Detecting Overloaded Trucks

The Automobile Division of the Pennsylvania State Highway Department has furnished its inspectors with lodometers or jack scales for detecting and obtaining evidence against automobile trucks that are carrying overloads on their machines. The lodometer is a mechanism with a jack attachment which is placed under the axle of a truck suspected of being overweight. Two lodometers are placed under an axle and jacked up and the dials on the lodometer give the weight carried by each, the sum of two being the total weight on that axle. The weight on the other axle is then determined in the same way.

Under the state law, trucks must have painted on the outside the maximum weight limit permitted by the manufacturer of the car. If the lodometer indicates that this weight limit is exceeded, the inspector takes the truck to the nearest scales where the weight is checked up.

The inspectors find that there are many violations of this law after dark, there being a steady stream of heavy motor trucks plying constantly day and night between Philadelphia and points in New Jersey and New York. The fine for overloading a truck is from $25 to $100 and costs, or six months in jail. The fine goes into the treasury of the municipality in which the arrest is made.

War Department Favors National Highways

As a result of the trip made by the seventy-three army trucks from Washington to the Pacific coast last summer, the War Department reported on July 18th to the Highway Committee of Congress its conclusion that there was need for a comprehensive system of national highways, the recommendations of the department being as follows:

"First—That the necessity for a comprehensive system of national highways including transcontinental or through routes east and west and north and south, is real and urgent, as a commercial asset to further colonize and develope the sparsely settled sections of the country, and finally as a defensive military necessity.

"Second—That the existing roads and bridges especially in the sparsely settled sections of the middle and far western states, are absolutely incapable of meeting the present day traffic requirements, and until modern types of roads and bridges are constructed which will permit the rapid movement of heavy motor cargo vehicles during any season of the year and in all conditions of weather, economical transcontinental highway traffic will continue to be but a vain hope.

'Third—That the road problem of the middle and far western states are national rather than local problems, as these states, while possessing vast area and tremendous milage of highways, have only a sparse population which cannot possibly undertake the needed highway improvement work, which more over is usually of greater importance to the country as a whole than to the individual states.

"Fourth—That the radius of action and resulting utility value of the motor vehicle is limited only by the condition of the roads, and that the provision of adequate roads will have a far reaching effect on the economic development of the country at large.

"Fifth—That the types of motor vehicles, especially those used by the army, should be coordinated with the road conditions. In other words, until such time as all sections of the country are connected by improved highways that are passable to heavy motor vehicle traffic at all seasons of the year, the size and weight of vehicles should be limited to types of light and medium capacities."

A New Method of Driving Piles

Precast foundation piles uninjured by very severe driving with double acting steam hammer to penetration of 33 feet through fill, stiff clay and sand to a refusal of 565 blows per inch although resistance caused piles to fracture in tension when pulled.

Severe driving is often necessary when piles are installed in very hard ground or encountering obstacles in softer ground When, as is sometimes the case, it is necessary to strike thousands of blows on the pile head with a two-ton or three-ton hammer there is danger of injuring or destroying the pile, especially if it is of concrete.

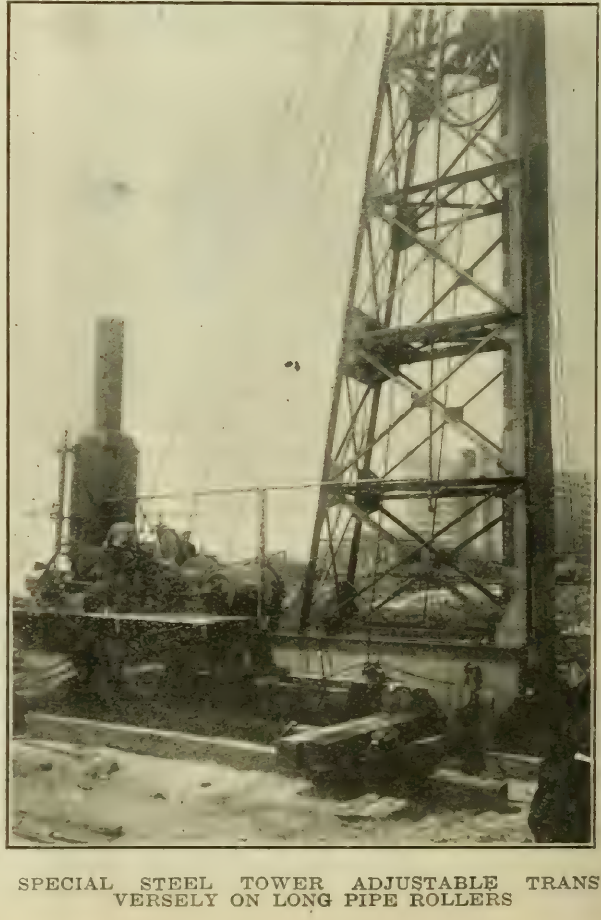
The improved method, here described, of relieving the pile of compression and battering from tremendous hammering, and actually pulling it down instead of pushing it, enables it to endure excessive punishment without injury and to be driven under conditions too severe, and to depths too great for ordinary practice. Besides removing one of the principal objections to the use of precast concrete piles in many places when they are most desirable, this method is applicaable to most all other kinds of piles, and its development is of interest and value for a good deal of substructure and permanent and temporary construction work.

Parties interested in the design, construction and promotion of such piles gave a demonstration of the driving of them by this method on May 6, 7 and 10 in Long Island City before a number of prominent engineers, architects and contractors. There long and heavy precast concrete piles of a make known as the "Giant" were driven 33 feet into very hard ground by severe hammering.

The piles were 44 feet long and 16 inches square with chamfered corners and were each reinforced with four 7-8-inch square twisted steel bars and a 400-pound pyramidal cast-iron driving point. They were driven by a double-acting No. O "Union" steam hammer making 110 strokes per minute and operated by a three drum, three-spool 60 h.p. Lidgerwood steam hoisting engine on the platform of a special steel tower.

Preliminary exploration borings had indicated the soil to consist of 13½ feet of fill, 10 feet stiff blue clay, 3-feet silt, 8-feet compact fine blue sand, 6-feet hard clay and 1 foot sand and clay overlying the rock. One of the piles was driven without the assistance of a water jet, one was driven with a jet under a hydrant pressure, and the third was driven with a jet under pump pressure, but no difference was observed in the driving of the three piles. The piles penetrated 26½ feet through the fill, the blue clay and the silt under a very few hammer blows in a total time of 4 minutes, after which the penetration through about 6½ feet of the compact fine blue sand was very slow and difficult, involving unusually heavy punishment for the piles, which was intentionally maintained for about 30 minutes of continuous driving to show their high degree of resistance and was finally discontinued when the pile was only moving at the rate of 1 inch penetration for 565 blows.

One of the piles was withdrawn for about two-third of its length without injury and then broke in several places under the very heavy tension force applied. The second pile was also withdrawn without injury for about two-thirds of its length when the pulling tackle failed and after the latter had been reinforced and supplemented by a 350-gallon hydraulic jet at 250 pounds pressure, the pile was completely withdrawn and proved to be in perfect condition except where fractured by the ecentric pull of the hoisting engine with its different drums operating on a 12-part tackle and on two single lines. With these powerful stresses; it required about one hour to withdraw the pile.



SPECIAL STEEL TOWER ADJUSTABLE TRANSVERSELY ON LONG PIPE ROLLERS

SPECIAL STRUCTURAL FEATURES

The reinforcement rods, which projected beyond the top of the pile to bond with the concrete superstructure, were hooked at the bottom into the cast-iron driving point, and were embedded in the corners of the pile about $2\frac{1}{2}$ inches from the surface. Opposite sides of the driving point projected beyond the corresponding faces of the pile to give bearing for the lower ends of two duplicate full-length, heavy channel-shape detachable driving bars with clearance between them and the faces of the pile, that were connected, with clearance above the top of the pile, by a heavy steel driving cap that received the hammer blow and transmitted it to the driving point without impact or compresion of the concrete and acted to pull the latter down into the ground.

The arrangement of the driving bars provided for the complete protection of four 2-inch jet pipes in the spaces made vacant by chamfering the corners of the concrete pile. The lower ends of these pipes engaged sockets in the cast-iron driving point and communicated with outlets through which the jet could be applied to the soil below and around the pile permitting the return water to flow up to the surface of the ground between the driving bars and the surface of the pile, without danger of scouring the ground outside the driving bars. It is also possible to drive the piles with jets arranged outside the driving bars if preferable. After the driving has been completed, the driving bars are detached and removed and, if the earth does not immediately close in, as usual, to fill the space around the pile vacated by the bars, the voids can easily be filled with sand puddled by flowing water and giving a large degree of resistance to displacement of the pile.

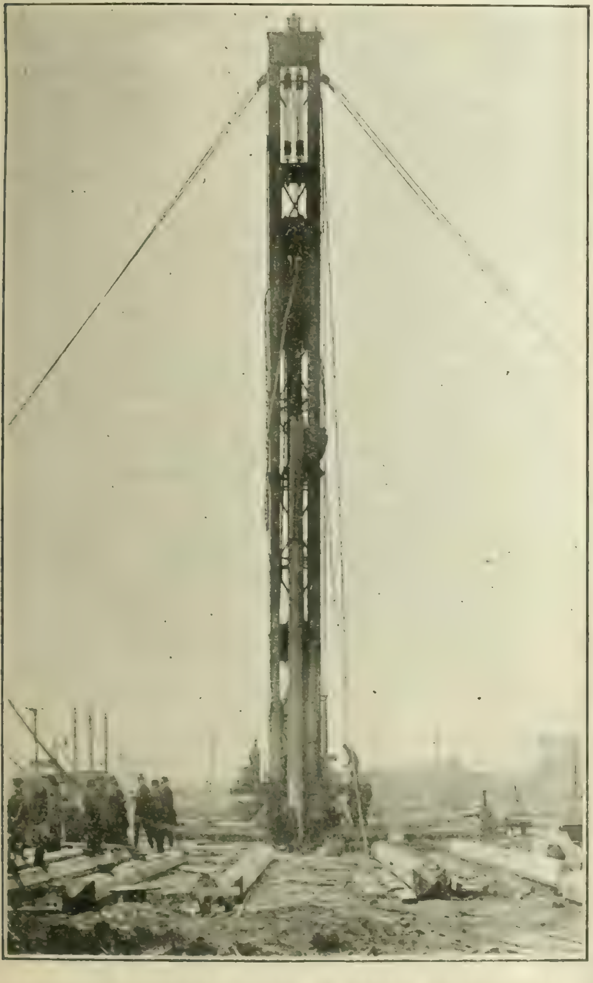
FROZEN PILES

Piles were made with 1:2:4 concrete composed of Portland cement, graded sand, and crushed trap rock from ¾ inch to ¼ inch in diameter. They were cast at temperatures varying from 20 to 33 degrees Fahrenheit and although all of them were frozen, they were not cured with steam as is frequently customary in cold weather, because it was intended to demonstrate that with this method of driving, the freezing of concrete was not unpermissible. The long and heavy piles were handled by a tackle attached at a single point and the cracking thus occasioned might have been avoided if the lifting tackle had been attached at 3 points, as is often done.

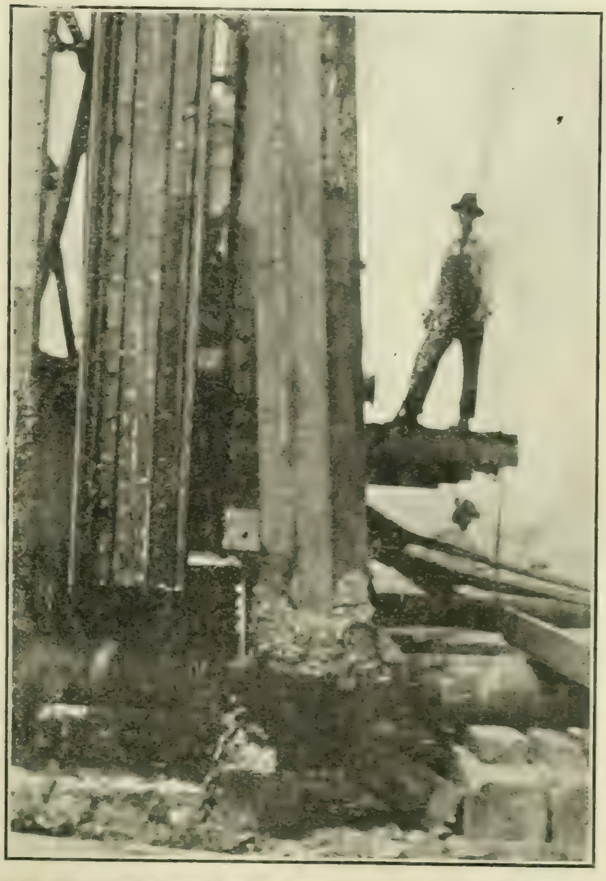
ENGINE AND TOWER

The 60-h. p., 3-drum, 3-spool Lidgerwood hoisting engine used to handle the piles and the steam hammer, was mounted on the platform of a special steel tower having a capacity for driving piles up to 24-inches square and 65 feet long.

The tower was made of riveted angles on a heavy I-beam platform that had special transverse roller bearings locked to a pair of long steel tubes, one at each end of the platform, under the



PRECAST CONCRETE PILE IN WAYS OF SPECIAL STEEL DRIVING TOWER



FOOT OF CONCRETE PILE UNINJURED AFTER VERY HEAVY DRIVING AND PULLING centers of the tower and the hoisting engine respectively, thus giving the apparatus a transverse base about 40 feet in length. Longitudinal motion was secured by rolling the long tubes, and transverse motion by hauling the tower from end to end with tackles attached on each side as shown in the illustration. This enabled the tower to be easily and quickly adjusted for different positions of the piles and to drive a large number of piles in a single cluster or in multiple rows close together. The apparatus is so arranged as to permit the application of about 30 tons of its weight to the pile while the latter is being driven, thus considerably facilitating its penetration, especially in soft soil.

Besides the result shown in this demonstration, the efficiency of the pile and driving system have been shown on U. S. Government work at Wilmington, N. C., where Giant piles of the same size were driven through 6 feet of massive brick engine foundation, 18 inches of long leaf yellow pine grillage, 5 feet of stiff blue clay, 5½ feet of sticky blue clay, 2 feet of sandy clay and 3 feet into coral rock.

Labor Notes

Safeguarding Immigration

The U. S. Public Health regulations require physical examination and medical certificates of good health, cleanliness and freedom from contagious diseases to be certified to at the port of foreign embarkation. Because these regulations have been neglected or misunderstood at some foreign ports, there are now being daily detained on their arrival at the port of New York more than 1,000 Italian immigrants who are quarantined at Hoffman Island, where they are examined, tested, vaccinated, deloused, if necessary, bathed and finally passed after a detention of 24 hours or more as required. Their clothing and baggage are sterilized by steam and they are afterwards transferred to Ellis Island for examination by the immigration authorities.

Increasing Arrivals

In the week ending July 24th, sixteen ocean liners delivered 13,970 immigrants to the port of New York. They represent most of the European countries, excepting those which were opposed to us in the war. They include many able-bodied men and numerous families and, unlike the immigrants arriving before the war, who in large quantities remained in New York, are generally definitely decided to go to some inland points.

Transient Immigrants

A few days ago there passed through New York a trainload of 530 Chinamen enroute from Montreal to Cuba via the Ward Line Steamship. They were escorted by a guard of 20 men and practically passed through the city in bond, under an agreement of the authorities that none should be permitted to escape and remain in this country, although the penalty was not comparable with that of about $1,000 for each individual that might stray from the party during the trip through Canadian territory from Vancouver to the United States boundary.

The immigrants represented all classes of Chinamen, from servants to mechants and students, excepting the typical cooley laborers.

Such shipments have been frequent for many years and go to show and call attention to the almost inexhausible supply of labor of all kinds which we well might draw from the 800,000,000 inhabitants of the Chinese Empire, were it not for the absurd and mischievous restrictions that have been demanded and secured for political capital on account of labor union selfishness and jealousy.

The Chinese are willing, faithful and notably honest and under proper regulation the admission of a large number of selected immigrants from their numbers, far from interfering with native labor or lowering its standards and rewards, would relieve them of much of the work that they refuse to do and tend to still further classify and specialize labor so that it would be pleasanter, more efficient and better paid.

100,000 Potential Immigrants

A commission from Russia including a civil engineer, the head of a large hospital, and two university professors, now visiting the United States, is looking for locations for 100,000 destitute Mennonites of the Russian Ukraine, formerly members of the wealthy Russian aristocracy in a rich argicultural section, who have been ruined by the political disasters in Russia and are seeking new homes in America, Austrialia and Africa.

Their property has been confiscated and pillaged to a large extent and they are desirous to sell the remainder at any price and seek new countries. About 80 per cent of the colony are farmers with holdings of 180 to 60,000 acres and would probably make useful productive citizens with a wholesome hatred of bolshevism, socialism, and all other kinds of pernicious radicalism.

Surplus Labor in Hamburg

According to the U. S. daily consular report of July 21, there were on June 12th, 35,028 unemployed male and female workers in Hamburg, which showed an increase of 1,823 over the preceding week. Although only classified workmen are included in the list, it indicates a considerable surplus of labor and a positive supply of workers for this country. Presumably those of the least skill in their various industries form the bulk of the unemployed and many of them may perhaps be below the rank of mechanics and well suited for ordinary unskilled labor in this country. Among the largest groups of unemployed males are 3,493 in metal and machinery industries, 1,126 in wood industries, 2,351 in food stuff industries, 1,261 in building trades, 1,315 machinists and factory workers, 3,645 commercial trades and 12,144 paid workers and household help.

Recent Legal Decisions

STATUTE REQUIRING TWO SURETIES ON BOND OF CONTRACTOR FOR SCHOOLHOUSE MUST BE FOLLOWED

The Nebraska statute requires a bond given by a contractor upon the erection of a schoolhouse to be signed by two sureties. A bond for the contractor for a schoolhouse was executed and approved signed by one surety only. A materialman furnished building material to the contractor, who failed to pay the bill. In an action by the materialman on the bond, the Montana Supreme Court holds, Nye-Schneider-Fowler, Co. v. Roeser, 177 N. W. 750, that the surety was entitled to rely upon the performance of the legal duty of the school board to see that a bond in accordance with the statute was executed before the contract was let, and that, the bond being of a public nature and accessible in the hands of the school board to the inspection of interested parties, no estoppel arises on the part of the surety on the ground that, the materialman having furnished the goods relying upon the bond, the surety is estopped to deny its validity. The surety who signed was under no duty to see that another surety signed the bond. The court's former opinion in the case (103 Neb. 614, 173 N. W. 605) was set aside.

"IMMEDIATE" NOTICE OF DEFAULT TO SURETY ON PAVING CONTRACT

A surety bond for a paving contractor required the owner to give immediate notice of default by the principle contractor, or of omissions by him, which would cause damage for which the surety would be liable. The Michigan Supreme Court holds, Berkshire Land Co. v. Moran, 177 N. W. 205, that the word "immediate" in such a provision is not used in its strict meaning as without any time interviewing, or instantly; but it requires prompt enough notice to enable the surety to take available steps for its protection. Failure to give notice within a reasonable time of the contractor's default when the price of paving, labor and material were constantly and rapidly increasing, will discharge the surety. A delay of 30 days after the expiration of the time for completion in notifying the surety, through the contractor's inability to finish within the required time was apparent before its expiration, and he definitely abandoned the contract three weeks before the notice was given, was held unreasonable and discharged the surety.

ADVANCES BY BANK TO CONTRACTOR FOR LABOR AND INDUSTRIAL CLAIMS

A contractor agreed to deposit in a bank all the money he received for constructing a school building. The bank agreed to advance the money he might need to enable him to complete the building and to take his notes for the amounts advanced. Moneys so advanced, as well as money received on the contract, was to be used only to pay claims of laborers and materialmen. Pursuant to this agreement, the bank took the contractor's notes for $5,000 and an order on the school district for that amount, and advanced $4,500 to pay claims for labor and materials. The contractor had given the statutory bond with surety. He failed to pay the claims of the laborers and materialmen, and also failed to pay his notes to the bank. In an action by the surety on the contractor's bond against the contractor, the school district, the bank and the holders of claims for labor and material, the Minnesota Supreme Court holds, New Amsterdam Casualty Co. v. Murtz, 177 N. W. 664, that the school district, having paid the bank's order was liable to the surety only to the extent of the unpaid balance of the contract price, and the surety was required to pay the remaining claims of the laborers and materialmen. The right of the bank to retain the money received from the school district was superior to the surety's right to be subrogated to the interest which laborers and materialmen had in the money retained by the school district until the contractor completed the building. The school district neglected no duty it owed the surety in honoring the bank's order, although the surety had previously notified it not to pay orders given by the contractor, since it was bound to pay the contract price under the contract.

PUBLIC IMPROVEMENT CONTRACT VALID THOUGH RESOLUTION FOR BIDS PASSED BEFORE ORDINANCE EFFECTIVE

In an action to have a contract for a street improvement declared invalid because the resolution directing the advertisement for bids, pursuant to which the contract was awarded, was passed before the expiration of 60 days after publication of the ordinance authorizing the improvement, and hence before the ordinance went into effect under the terms of the New Jersey Home Rule Act, the New Jersey Supreme Court, Methling v. Board of Comrs. of City of Orange, 110 Atl. 133, is of opinion that, that fact does not render the contract invalid where the date fixed in the advertisement for bids was after the ordinance became operative under the provisions of the Home Rule Act.

DOUBLE MEASUREMENTS FOR EARTH EXCAVATION BY MISSOURI STATUTE

Under the Missouri Statute of 1909, providing how measurements of earthwork, excavation, etc., shall be made in the absence of special agreement, the Missouri Supreme Court holds, Webb-Kunze Constr. Co. v. Gylsonite Const. Co., 220 S. W. 857, that a contractor to excavate for a building was entitled to compensation on the basis of double measurement for trenches and pier holes as provided in the statute, despite an article of the contract and a provision in the specifications which were not inconsistent with the statute. The statute is held necessarily to apply to contracts for making earth excavations, and must be read as a part of every contract of that character.

NEWS OF THE SOCIETIES

August 14-18—ENGINEERING INSTITUTE OF CANADA, CALGARY BRANCH. Meeting at Banff. F. C. Emery, secretary. Western professional meeting, Calgary, Canada.

Sept. 7-16 — NEW ENGLAND WATER WORKS ASSOCIATION. Annual convention, Holyoke, Mass., Sevretary, Frank J. Gifford, 715 Tremont Temple, Boston, Mass.

Sept. 13-17—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual convention San Francisco, Cal.

Sept. 20-23 — SOUTHWESTERN WATER WORKS ASSOCIATION. Annual convention, St. Charles Hotel, New Orleans, La. Secretary, E. L. Fulkerson, Waco, Texas.

Oct, 12-14. – AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. St. Louis, Mo. Secretary, Charles Carroll Brown, 401 Lincoln Avenue, Valparaiso, Ind.

Oct. 19-22—INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. 25th annual convention, New Orleans, La. Secretary, C. R. George, Houston, Teaxs.

Jan. 25-27, 1921—THE AMERICAN WOOD PRESERVERS ASSOCIATION Annual convention. Place to be announced.

SOUTHWESTERN WATER WORKS ASSOCIATION

The Association will hold its annual convention at New Orleans on September 20th to 23rd, with headquarters at the St. Charles Hotel. It is hoped and expected that this will be the best convention which the Association has yet held.

Attention is called to the fact that the date which has been given for several weeks past in our Convention calendar, September 13 to 17, is not correct, but that the Convention will be held on September 20 to 23.

ADVISORY COUNCIL TO THE BOARD OF SURVEYS AND MAPS

At a recent meeting at Washington, D. C., the organization was completed of the advisory council of the board of surveys and maps for active work during the present season in the preparation of a report to be submitted to the general meeting in Washington, September 14th.

Besides the committees on cooperation, technical standards, topographic maps, highway maps, general maps, control and information, there is an executive committee consisting of Dr. E. B. Mathews, Division of Geology and Geography, National Research Council, chairman; A G. Seiler, American Automobile, Association, secretary Wm. A. Nelson, president of the Association of State Geologists; A. Stuart Baldwin, vice-president, Illinois Central Railroad; J. H. Milburn, office engineer, Baltimore & Ohio Railroad.

THE IOWA ENGINEERING SOCIETY

The Iowa Engineering Society has voted favorably on the admission to membership of all members of existing local organizations and action is expected to be taken in this dircetion next fall.

THE AMERICAN SOCIETY OF WOMEN ENGINEERS AND ARCHITECTS

In December, 1918, steps were taken for the formation of a society which has since been organized for the general and professional interests of women employed in engineering and architectural work, and for the publication of papers and other data in an official periodical.

The society, which owes its inception to female members of the university of Colorado, is intended to be representative of 200 women in the specified fields who are eligible if they are college graduates or have had the required amount of practical experience. The present membership is said to include all individuals employed in civil, electrical, chemical and architectural work. The officers are Lou Alta Melton, pres., Hilda Counts, vice-president, and Hazel I. Quick, secretary and treasurer.

AMERICAN ASSOCIATION OF ENGINEERS

As a result of the efforts of the Boston chapter of the American Association of Fngineers, the employees of the state highway division of the Massachusetts department of public work have been granted an increase in salary averaging 20 per cent and effective on June 1, 1920. Other engineering departments were given an increase which is reported to average about 12 per cent.

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS

The annual convention ofthe American Society for Municipal Improvements will be held at St. Louis, Oct. 11-15. The convention officials are being aided by six committees of local engineers and contractors, including representatives of the municipal departments. The mayor of the city has invited mayors and municipal officials throughout the country to attend the meeting and special conferences will be arranged for them. The president of the board of Public Service has also invited more than 3,000 engineers throughout the country.

PAN-PACIFIC SCIENTIFIC CONGRESS

Convention to be held in Honolulu, Hawaii, Aug. 2-20.

SOCIETY OF MILITARY ENGINEERS

The first annual meeting of the Society of American Military Engineers will be held in Washington, January 14. The temporary board of directors at a meeting on June 2, perfected the preliminary organization and elected as officers to serve until the annual meeting. Directors, Cols. F. V. Abbot, F. A. Molitor, George D. Synder; Lt. Cols. C. H. Birdseye, A. H. Brooks, J. H. Finney, H. S. Graves, W. W. Kirby, Geo. B. Pillsbury, Glenn Smith, Evarts Tracy, G. A. Youngberg; Majors. Percy E. Barbour, P. S. Bond, J. J. Kingman, Max C. Tyler, E. Tufts; Capt. D. McCoach; Executive committee, Maj.-Gen. Black, Cols. Brooks, Graves, Major Tufts and Capt. Weart; Committees: Development, Major Bond, chairman; Cols. Molitor, Snyder; Lt.-Col. Finney, Major Barbour. Design of Emblem, Lt.-Cols. Youngberg, and Tracy. Membership, Lt.-Col. Youngberg, Majors, Edwin H. Marks, William J. Shea and Capt. Thomas H. Messer.

ASSOCIATION OF PROFESSIONAL ENGINEERS OF ALBERTA

The first general meeting and organization session of the Association of Professional Engineers of Alberta, Canada was held at Calgary, July 10 in accordance with an act of the Legislature of the Province of Alberta. The membership of more than 100 engineers has been enrolled and there were elected as officers, President, F. H. Peters, commissioner of irrigation; vice-president, L. E. Drummond, consulting engineer and manager; registrar and secretary, R. S. L. Wilson, professor of civil and municipal engineering University of Alberta, Edmonton. Councillors: S. G. Porter, R. J. Gibb, and R. A. Brown.

TEXAS WATERWORKS ASSOCIATION

A meeting of the Texas Waterworks Association, was held in Austin, July 20, Prof. R. G. Tyler, engineer of the University of Texas presiding. Among the papers presented was one by H. E. Elrod, Dallas, Texas, on the cost of water mains, selection and cost of power plants and distributing systems for small towns.

NEW ENGLAND WATERWORKS ASSOCIATION

The 39th annual convention of the New England Water-Works Association will be held at Holyoke, Mass. Sept. 7-10th, where there will be provided in the City Hall a 75x96-foot exhibit and meeting room in which allotments of 20 square feet each will be allowed to each member of the Waterworks Manufacturers' Association. Additional space can be secured at the uniform rate per square foot, and electric current at 110 volts can be supplied. For particulars and application, address Burt B. Hodgman, chairman exhibit committee, Waterworks Manufacturers' Association, 50 Church Street, New York.

PERSONALS

Wilkes, Edmunds, has opened a structural engineering office in Kansas City, Mo.

Murry, R. H., has been appointed director of the Division of Sanitation of the Bureau of Public Health of Saskatchewan, Canada.

Rose, H. C. has been appointed resident engineer of Provincial highway in Western Ontario, Canada with headquarters at Guelph.

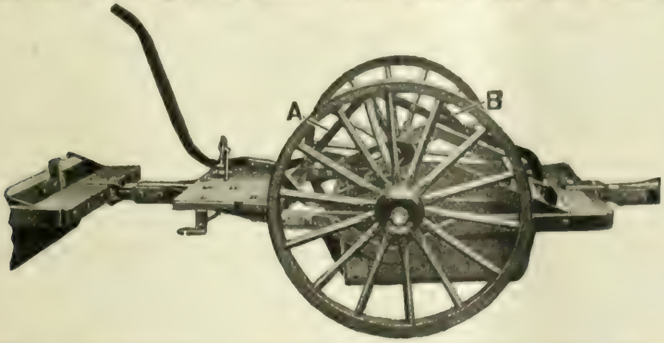
Ennis, W. D., has resigned the position of professor of engineering in the U. S. Naval academy, Anapolis, to become vice-president of the Technical Advisory Corporation of New York

(*Continued on page* 142)

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

MULTI-UNIT WHEEL SCRAPERS


MULTI-UNIT WHEEL SCRAPER WITH ARCHED AXLE AND PROTECTED SPINDLES

The Roytrack multi-unit wheel scrapers made by the Smith & Sons Manufacturing Company, are designed to be operated tamden in trains hauled by a tractor. Any number of scrapers, according to the conditions of digging and the horse-power of the tractor at the draw bar, can be operated by one man attending to the tractor and another attending to the scrapers.

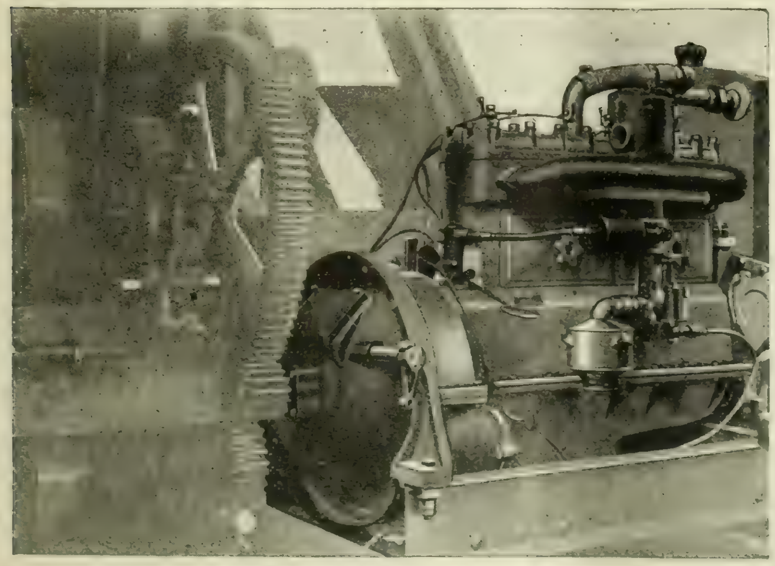
The scrapers have high carbon steel bowls, steel axles and steel wheels with bearings protected from dirt and dust. Before starting to load, the bowl is locked in clearance position. When it is realeased by the control lever, the bowl is shifted to engage the earth and when it has been filled, it is raised to carrying position by moving and locking the control lever preferably while the tractor is in motion.

When the trip latch rod is pulled, the bowl is lowered to the ground and the draft of the tractor causes the rear end of the pan to rise and move forward, dumping the load. When several scrappers are used tamden, the best results are obtained by releasing the lock after each scraper has been loaded. The pan will then be held in place by the control lever until the operator, standing at any required point can dump them as they pass without mounting them or stopping the tractor.

The crapers are made in four sizes with 9, 12, 14 and 16 cubic feet capacity and weight 725,950, 1150, and 1250 pounds each respectively.

GASOLINE PAVING MIXERS

The 1920 Smith simplex paving mixer with gasoline equipment has been designed by the manufacturers in an effort to secure the most economical and convenient fuel obtainable. Their engineers have studied conditions and construction problems for years and have developed details that they consider to be very successful and recommend unreservedly to road and pavement contractors. It is believed to overcome troubles that previously seemed to baffle deisgners and discouraged previous attempts to adapt gasoline engines to paving machines.


GASOLINE SIMPLEX PAVING MIXER

SHUVELODER

The "Shuveloder" is a "medical mucker" that has been designed and perfected and is now put on the market by the Lake Superior Loader Company. It is of simple, compact, sturdy construction designed especially for loading muck in the limited headroom and small clearance of tunnels, drifts and cuts.

The machine is mounted on a turntable carried by a truck running on short lengths of portable track put down in front as it advances. It has capacity for pieces of rock up to the size of the 30-inch bucket and can dig far enough below the level of the track to handle more than 95 per cent of the muck from an 11-foot drift without assistance of trammers.

It can be operated in a drift 5-feet wide and 7 feet high, can reach 5½ feet each side the center line of the track, and can be transportated complete through a 4½x4½-foot drift. It will load into any ordinary tram car not exceeding 50 inches in height above top of rail.

The bucket is operated by four pneumatic cylinders working directly without gears, chains, clutches, belts, conveyors, or engines, thus producing great simplicity and a minimum number of moving parts.

The machine is controlled by three hand levers on one side. They govern the plungers in the cylinder, that, with links and a rope on the revolving shaft, push the bucket or dipper forward into the bottom of the muck pile where it is given a crowding stroke followed by a digging stroke that carries it up to horizontal, after which the bucket and its arms are moved back in horizontal where the bucket is elevated and guides to the rear of the machine, reverses to dump into the car and then returns for another load. When swung transversely by the hand-operated swinging gear, the bucket will reach 5½-feet from the center line of the track and, under all circumstances, discharges into the center of the attendant car.

When the bucket strikes a solid obstruction it will automatically dig over it without stalling. If the bucket is momentarily retarded, the development of air pressure in the cylinder is prevented by the oil filling in the hollow plungers.

The machine is so light that it is readily propelled forward and back by hand, thus obviating the expense and complication of mechanical traction. It can be moved thus as easily as an ordinary 2-ton loaded tram car. The machine is handled and the cars loaded by one operator and the number of additional men required is determined principally by the rate at which the empty cars can be delivered to the machine.

The machine is 4-feet wide, 4-feet high and 6-feet long, weighs 4,300 pounds and has a loading capacity of 45 tons per hour. It consumes from

150 to 175 feet of free air per minute at 80 pounds pressure, and has a bucket capacity of 4.45 cubic feet. The headroom required for operation is 6 feet 10 inches.

INDUSTRIAL NOTES

W. G. THOMPSON ASSOCIATED WITH LAKEWOOD ENGINEERIN GCOMPANY

The Lakewood Engineering Company announces the association of W. G. Thompson, formerly state highway engineer of New Jersey, with their New York City office at 141 Centre street.

Mr. Thompson's experience includes general civil engineering work, waterworks and street railway location and construction in private practice, dredging and breakwater work for the federal government, five years experience in survey and construction work on the Panama Canal, work in the chief engineering office of the Oregon & Washington Railroad, and concrete pile construction up to 1917, when he was appointed assistant state highway engineer of New Jersey, and in 1918 became state highway engineer in full charge of the state highway department and its work.

2000-PARKER MOTOR TRUCK CONTRACT

The Parker Motor Truck Company, Milwaukee, announces the closing of a contract with the Wilson & Vevera Corporation, New York City, involving the distribution of two thousand trucks.

The Wilson & Vevera Corporation are jobbers and will represent the Parker line in eight Eastern States. Dealers will immediately be established in principal cities, and truck deliveries will start August 1st.

FIRE DAMAGED QUICKLY REPAIRED

The United States Asphalt Refining Co., New York, writes. On July 19th one of our tanks containing a storage of crude oil was struck by lightning. The fire was very stubborn and burned for several days, and three tanks of crude oil was consumed, also the laboratory. The remaining portion of the refinery and other storage of oil were saved after a hard fight. Property adjacent to the refinery was also damaged to a great extent.

After cleaning up, manufacturing and shipments will be resumed as usual by end of week.

Very truly yours,
The U. S. Asphalt Refining Co.

DWIGHT P. ROBINSON & CO., INC.

Dwight P. Robinson & Co. Inc., and Westinghouse, Church, Kerr & Co. Inc., have consolidated under the name of Dwight P. Robinson & Co. Inc. thus uniting two large organizations of engineers and practical builders with many years experience in large and difficult undertakings.

Dwight P. Robinson & Co. Inc., has specialized in designing and construction of steam power plants, hydro-electric developments, transmission systems, steel mills, reinforced concrete and steel structures.

Westinghouse, Church, Kerr & Co., Inc., has had 36 years experience in the design and construction of industrial plants of every type, shops, foundries, railroad terminals, electrial and industrial power plant. Offices of the new firm are at 125 E. 46th St., New York, and at Chicago, Pittsburg, Cleveland and Dallas.

LOUIS M. LAYNE

Louis M. Layne, vice-president of the Layne & Bowler Company, Memphis, Tenn., and of Layne & Bowler Corporation, Los Angeles, Calif, died June 27th.

SPECIAL USES FOR TARVIA

The Barrett Company has just issued an attractive pamphlet with the above title that is devoted to the presentation of valuable information concerning problems that confront the engineer and street superintendent in the maintenance of highways.

Among the various topics considered are, Tarvia for the repair and maintenance of concrete, Surface coats on concrete. The repair and maintenance of bituminous macadam and other bituminous surfaces. Repair and maintenance of macadam surfaces. The use of tarvia over worn brick pavements, Tarvia for shoulders, cold patching with tarvia—k.p., Protective surfaces on plank bridge floors, Treatment of wood block pavements with tarvia-B, Tarvia bound bases, Treatment of slippery pavements with tarvia-B and sand Treatment of walks and pathways in parks, cemeteries and private estates with tarvia, Treatment of gravel and shell roads, Tarvia for gutters and waterways, Tarvia on gravel roads, Tarvia service department and free literature

Detailed descriptions are given of the methods, operations and materials required for different kinds of repairs and construction and are illustrated by engravings of work in progress and finished roads; besides which, there are notices of various pamphlets that will will be sent on application covering such subjects as how a tarvia-macadam roadway is constructed, tarvia for bridge floors, good roads at low cost tarvia, and several others of a similar character.

WATERING DOWN THE ROAD

Under this title the C. H. & E. Company, Inc., issue an attractive circular, printed in colors and devoted chiefly to single-acting triplex plunger pumps that are adapted for construction purposes, especially to provide water for concrete mixing and for sprinkling newly finished roads.

These pumps, mounted on trucks are easily shifted from place to place and being geared direct to the engines, do not require constant attendance of an operator. The plungers are outside packed and thus are not affected by gritty water.

Illustrations are given of the pumps themselves and of their installation on a roadbuilding job where they delivered water through a 2-inch pipe for a distance of 3¾ miles at an elevation of 100 feet to provide for the concrete mixer and for the road watering.

The pumps, being operated with kerosine oil, do not require a licensed engineer. The use of a duplex outfit, composed of a pair of duplicate triplex pumps mounted on a truck and operating independently, is strongly recommended to save time in case of accidents or interruption of one pump and to provide double efficiency by using both pumps simultaneously if desirable. The pumps can also be equipped with a gasoline engine which, connected to the standard 3½x4-inch triplex pump, has a capacity of 40 gallons per minute to a maximum pressure of 200 pounds.

Where water must be raised from more than 20 feet below the surface, a deep-well working-head must be installed to raise it to the surface. The working head is operated by a belt from the pump engine and drives a pump rod connected to the plunger in the submerged cylinder, thus raising the water to the tank on the surface, from which it is pumped in the usual manner, through the pipe line.

PERSONALS

(*Continued from page* 140)

Murray, F. H. and J. R. Pennel have opened an engineering office in Charleston, S. C.

Moorefield, Chas. H., has been appointed state highway engineer of South Carolina.

Hammond, R. H. and F. H. Frauens, Jr., have organized the engineering firm of W. B. Rollins & Company, Kansas, Mo.

Berg, John, has been appointed state engineer of South Dakota.

Alden, H. W., is the representative of the Society of Automotive Engineers on the Federal Highway Council committee on transportation and on the committee on subgrade in relation to road surfacing.

Holland, W. E., has organized the waterworks construction firm of Cole & Holland, South Bend, Ind.

Buck, M. M., has opened an engineering office in Ottawa County, Mich.

Borck, Geo., has been appointed road engineer of Ottawa County, Mich.

Eavenson, H. N., has opened a mining engineering office in Pittsburg, Pa.

Thompson, W. L., has been appointed chief engineer of the Mississippi Levee Commission, Vicksburg, Miss.

Kelly, M. E., has been appointed assistant engineer for federal government improvements on the Virgin Islands.

Somerville, Robert, has been appointed assistant chief engineer of the Mississippi Levee Commission.

Heman, A. H. a contractor for much important public works in St. Louis, died at his home there July 3rd.

Hatton, H. W., died at Wilmington, Del., July 13.

Churchill, E. C., assistant division engineer of the Lehigh Valley Railroad died July 9.

Kelly, Lieut. Col. William of the U. S. Corps of Engineers, has been appointed engineer officers on the federal power commission.

PUBLIC WORKS.
CITY COUNTY STATE
A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"
Vol. 49 FLORAL PARK, AUGUST 14, 1920 No. 7

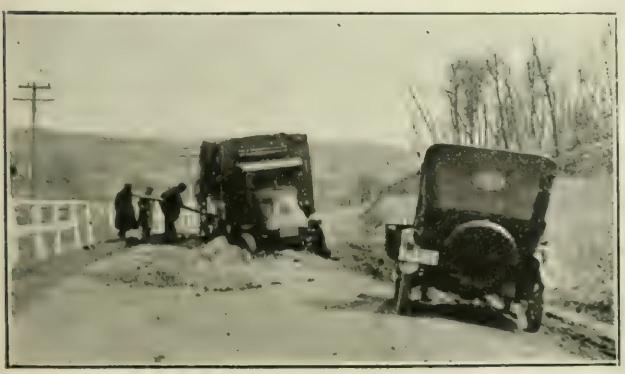
State Highway Maintenance in New York

Exceptionally heavy truck traffic during an unusually wet spring resulted in the total destruction of thousands of feet of high-grade bituminous concrete and asphalt block on the highways north of New York City. How temporary repairs, and later permanent ones, were made by the state highway forces is described in this article.

Probably as difficult a maintenance problem as is to be found in the State of New York is that presented to the engineers of the first division, extending along the Hudson river from New York up to a point a few miles south of Albany, and extending from the state line on the east to a western limit 20 to 40 miles west of the Hudson river. This includes the main highway which carries all of the traffic from New York north to Albany and a considerable part of that going into New England as well, while on the west are the routes followed by automobiles going from New York and New Jersey into the Catskill Mountains and the country west of the Hudson. In addition, there are many miles of less traveled highways and of roads connecting the farming sections with the main highways, but the problems presented by these are not unusually difficult ones. The total mileage being maintained approximates 1,300 miles.

The traffic of the main highway paralleling the east side of the river has always been heavy, and this highway has been improved from time to time until practically all of it is of bituminous concrete, with a small amount of cement concrete. Like most old highways in the east, this had begun as a water-bound macadam road, and the bituminous concrete surface which has been laid during the past 10 years has in almost every case been built upon the old macadam as a base. With the greatly increasing weight and number of vehicles using the road, the construction has been made heavier from year to year and condition improved. It was realized, however, that at some points the old macadam base was not sufficiently heavy and did not furnish so high a factor of safety for carrying this traffic as was desirable. This spring unusually trying conditions resulted in the factor of safety being exceeded in a number of places and in the almost total destruction of many short strips of road and the formation of numerous pot holes in other sections. This should not be considered as being in any way to the discredit of the highway department, since the conditions were so unusual and, even had they been anticipated, it would not have been possible to have undertaken the extensive reconstruction work necessary to meet them because of the scarcity of labor and materials and even of funds for the work during the several years previous.

The unusual conditions referred to were those of both weather and traffic. The ground remained wet much longer than usual this spring and in fact the unusual frequency of rains up to the present time has prevented it from drying out as thoroughly as it usually does. The traffic situation was even more unusual. Owing to the freight embargoes, strike and other reasons, every truck available in New York and New


BITUMINOUS MACADAM NEAR MONROE
[illegible]

ASPHALT BLOCK ON BOSTON POST ROAD.

England was used for weeks during the latter part of March and in April for carrying all kinds of freight between New York and the north. Probably as many as 2,000 trucks a day passed over this road, many of them weighing 5 to 8 tons. In fact, the engineers time and again saw as many as 12 to 14 rolls of news print paper on a single truck, each roll weighing about 1,300 lbs. giving a load of 15,000 to 18,000 lbs. in addition to the weight of the truck.

These trucks began operating over this road before the snow was gone and while the ground was still quite wet, and before long the soft spots in the subgrade made themselves evident by the wheels breaking through the pavement. The Highway Department immediately turned all their facilities onto the work of repairing these breaks as fast as they formed. Before the end of March they were operating all of the trucks owned by the department in this division and by the middle of April there were engaged in this work 40 state-owned trucks and 40 rented trucks, the former being 3-ton Packards or 2-ton Nash Quads, while the rented trucks were mostly half-ton or one-ton trucks of different makes. As many men were employed as were obtainable, reaching 500 to 700 in June.

The breaks were so numerous and frequent during this period that no time was given for making permanent repairs but up to the latter part of April all repairs were temporary only. In most places where the pavement broke through it was found that the clay below was soft for a foot or more. In raising a truck out of one of these mud holes the pavement around it was usually more or less broken, and in some cases 10 or 20 feet of pavement was crushed down into the soft sub-base before the truck could be gotten onto a part solid enough to sustain it. As soon as the truck had been removed, temporary repairs were made to permit traffic to move, there sometimes being from 20 to 50 trucks held up behind the one which had been stalled.

The temporary repairs consisted generally of filling the hole with anything available, stone walls along the road being the material most commonly used. The stones found in the walls in this section are mostly rather small and easily broken, so that a little hand sledging was all that was necessary to place them in shape for use. The stones having been driven into the sub-base as far as possible and brought up to a point two or three inches below the surface, they were covered with cinders which were packed down by the traffic, new cinders being added from day to day as required. The cinders were obtained form manufacturing plants in the nearest city and no charge was made for them. In perhaps the majority of cases, however, the farmers rendered bills for the stone walls used in these repairs.

After four or five weeks of this work there was a let up in this condition, probably both because the ground was beginning to dry out a little and also because most of the weak spots had been broken through. As soon as teams and men could be withdrawn from this temporary work, permanent repairs were begun and have been continued until, at the time of this writing (July 20) only two or three stretches remain to be completed, and these will undoubtedly be out of the way early in August.

These permanent repairs consist of patches from 1 foot square to stretches 800 feet long and the full width of the road, there being many from 50 to 150 feet long. In making the permanent repairs, the old cinders and stone were removed, until solid soil was reached. In some places the traffic over the temporary patches had driven the stone into the soil to a depth of three feet below the surface.* The bottom of the excavation was usually then covered with 6 inches of gravel, the chief object of which was to prevent the clay from being forced up into the sub-base. This was followed by 12 to 30 inches of sub-base stone carried up to within 6 inches of the surface, this by 3 inches of old macadam as an evener course, and the repair finished with a 3-inch surface of bituminous material.

Most of the wearing surface used has been cold patch material, because of the convenience of using this for small and scattered patch work; but where a repair job is more than 100 to 150 feet in length, hot bitumen is preferred, partly because it is quite a little cheaper. However, owing to the difficulty of obtaining materials, the department this year is using what it can obtain even though it may not always be what it would prefer.

In connection with the rebuilding of these sections of pavements, in a number of places sub-drains were placed, either tile drains or french drains, gutters were deepened and such other methods employed for draining the sub-base as were practicable considering the funds, men, material and time available for getting the road in condition.

At present the motor traffic is not so heavy as it was during March and April, but there are still perhaps 1,000 trucks passing over the road each 24 hours, a large percentage of these being quite heavy. On the part of this highway nearest to New York City most of the truck travel is at night, the trucks preferring to reach New York early in the morning, unload and load during the day, and start out again in the late afternoon. Thus there is comparatively little truck travel between 9 or 10 o'clock in the morning and 4 o'clock in the afternoon, but from 4 on until the following morning the trucks come in a continuous procession, the larger percentage traveling north during the first half of the night and south during the latter half. Owing to this condition, there would be little advantage in making repairs at night rather than during the day, but all of the work has to be done while this intense traffic is maintained.

Between Wappinger Falls and Fishkill, Poughkeepsie and Rhinebeck, and Hudson and Kinderhook was found most of the damage done to the road this spring and it is estimated that the sum of all the stretches repaired would total about two miles and the cost of making these repairs has been between $25,000 and $30,000 per mile.

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*See front cover of last week's issue.

For the regular maintenance the department used the patrol system to a large extent until this year, but this system has been practically abandoned except for a few isolated roads. Instead, the roads are now maintained by small gangs known as section gangs, in addition to which there are used in the division about 25 gangs for heavy work, which are sent wherever they are needed.

Each section gang has its own section of about 15 or 20 miles to maintain. Each gang consists of a foreman and from 4 to 7 men or sometimes as many as 10. The foreman provides a half-ton or a one-ton truck for which the State pays him a rental. This truck carries the picks and shovels, tamping tools and other hand tools as well as the men. Stone is placed in piles along the side of the road by special trucks so that the section gang trucks have to carry this material for only short distances. Barrels of bituminous materials also are kept on hand at intervals along the road. The State Comissioner is especially insistent that the piles of stone shall always be kept neatly shaped up, both because this tends to prevent the stone from being scattered and lost and also for apparance' sake. These section gangs do the regular maintenance, making small patches, cleaning out ditches, etc.

Where there is need for renewal work rather than patching, one of the heavy gangs is used. These gangs utilize the two-ton and three-ton state trucks, from one to three trucks being attached to each gang and from 10 to 40 men. A large part of the repair work is done with cold patch material, but the renewal work is largely hot mixed asphaltic concrete, and these heavy gangs are provided with the appliances necessary for constructing such pavement. The road rollers used are in some cases owned by the State and in others are hired for the purpose from local contractors or municipalities.

NEW CONSTRUCTION

Comparatively little new work is being laid this year, only about 10 of such contracts now being under way, although there are about 30 contracts under construction which have been continued from last year, while about 15 of last year's contracts have been abandoned.

BITUMINOUS MACADAM ROAD NEAR NYACK

Although the high prices of materials and labor have undoubtedly tended to restrict the amount of contracts let, the chief reason has been the lack of contractors to bid upon the work. In December of 1919, 13 contracts were advertised but bids were received on only 9, and on only 5 was there more than one bid. In January of this year 22 lettings were advertised, bids were received on 13 and two or more bids on only 6. In March 21 were advertised, 14 were bid upon and 6 received more than one bid. Most of the large contractors already have contracts carried over from last year, and probably the scarcity of both labor and material and the uncertainty of price movements have had considerable to do with the lack of bidders.

Both labor and material were very scarce during the spring but conditions with respect to both have now improved somewhat.

In this division sand can be obtained at comparatively short distances from most contracts. Stone can be obtained from New England quarries, being brough in coal cars returning otherwise empty to the mines. In sections of the country, however, where mines and quarries both lie in the same direction from the work under construction, it is impossible to obtain permission from the government to use open-top cars for hauling stone. At present there is considerable difficulty in obtaining cement, partly because of the scarcity of freight cars for transporting it and partly because the cement companies are not able to secure all the coal needed for manufacturing it. In general prices are from 15 to 20 per cent higher in this division than they

ASPHALT BLOCK ON BOSTON POST ROAD

ASPHALT BLOCK ON CONCRETE—BOSTON POST ROAD were in 1919 and over 100 per cent higher than they were three years ago.

About 75 per cent of new work that has been let this year is concrete, all of it reinforced. The standard road bed is now 16 feet wide, although 18 feet or even 20 feet will probably be adopted where possible in the future. For 16 feet width the concrete is made 7 inches thick in the center and 6 inches thick on the sides. The old macadam road which concrete replaces is scarified and the loose material surfaced and rolled with a 10-ton roller. It is necessary to scarify the old road in most cases because the crown is considerably higher than is desirable for a concrete pavement. The reinforcement regularly employed is specified to consist of main members having a cross-sectional area of not less than .06 square inch per lineal foot of road and spaced not more than 6 inches apart, while the tie members are not more than 12 nor less than 8 inches apart; the two sets of members being placed at right angles and the total reinforcement weighing not less than 25 lbs per hundred square feet.

At at least two points between New York and Buffalo it is planned to construct a pavement 24 feet wide consisting of two 9-foot strips of concrete with a 6-foot strip of bituminous concrete in the center. One such section west of Albany was begun last year, one of the 9-foot concrete strips having been constructed.

All work in the First Division is in charge of James H. Sturdevant, division engineer. Maintenance is in charge of E. J. Howe, resident engineer in charge of maintenance. The writer is indebted to both of these for information, photographs and other courtesies extended to aid him in the preparation of this description.

Hartford, New Jersey, Sheet Asphalt Mixing Plant

Contractor's central installation with capacity of 3,000 square yards daily of binder and surface courses hauled hot to a maximum distance of 10 miles.

The completion during this year and next year of about fifty miles of sheet asphalt highways in the county of Burlington, N. J., will provide there a total of 60 miles of waterbound and oil-treated macadam roads from 14 to 16 feet wide which have been converted, generally on the old foundations, to asphalt pavements from a standard of 18 feet to a maximum of 30 feet in width.

This improvement will have involved laying about 500,000 yards of binder and top course having a combined thickness of 3 inches, all of which will have been mixed in a central plant installed by the Union Paving Company, contractor, at Hartford, Burlington County, N. J.

At the plant, which is of a semi-permanent character, there is always maintained in storage at least 1,000 tons of sand from the Norcross & Edmonds pit at Birmingham, N. J., where it is excavated by a steam shovel and delivered to railroad cars after the 6 or 8 inches of loam has been stripped from the surface of the sand deposit. The excavating shovel works on a face from 8 to 20 feet high, and loads from twenty to forty 40-ton cars daily. The cars are hauled about twelve miles to the asphalt plant and are unloaded by a locamotive crane with 65-foot boom and 1-yard clamshell bucket which will handle two cars per hour.

The broken stone, from Lambertville quarries, is shipped in cars and, like the sand, is unloaded and stored at the plant in 1,000-ton piles. From these piles, sand and stone are transferred by the locomotive derrick to a 40-ton hopper-bottom bin delivering to a 6x30-foot Coatesville drier equipped with two fuel oil burners. An electric pyrometer at the outlet automatically maintains a constant temperature of about 500 degrees in the sand discharged there. When the moisture of the sand does not exceed 10 per cent, the capacity of the drier is from 30 to 35 tons of sand per hour.

From the foot of the drier, the sand is delivered at a temperature of 500 degrees to the boot of a bucket elevator 30 feet high, which originally deposited the sand in a large storage bin. This arrangement was, however, found to be wasteful of heat and the large bin has been eliminated and the hot sand is now chuted directly from the elevator to a second auxiliary elevator which fills a 20-ton bin which supplies by gravity the weighing hopper at the mixer.

The drier is operated alternately on sand and stone, the latter being heated to from 300 to 325 degrees and elevated and delivered through protected chutes to the 50-ton storage bin that supplies the mixer.

From 100 to 120 tons of limestone dust, shipped by rail in 100-pound bags, is kept in storage, and as required the bags are emptied by hand into the boot of a bucket elevator delivering to an elevated storage bin adjacent to the hot stone and sand bins.

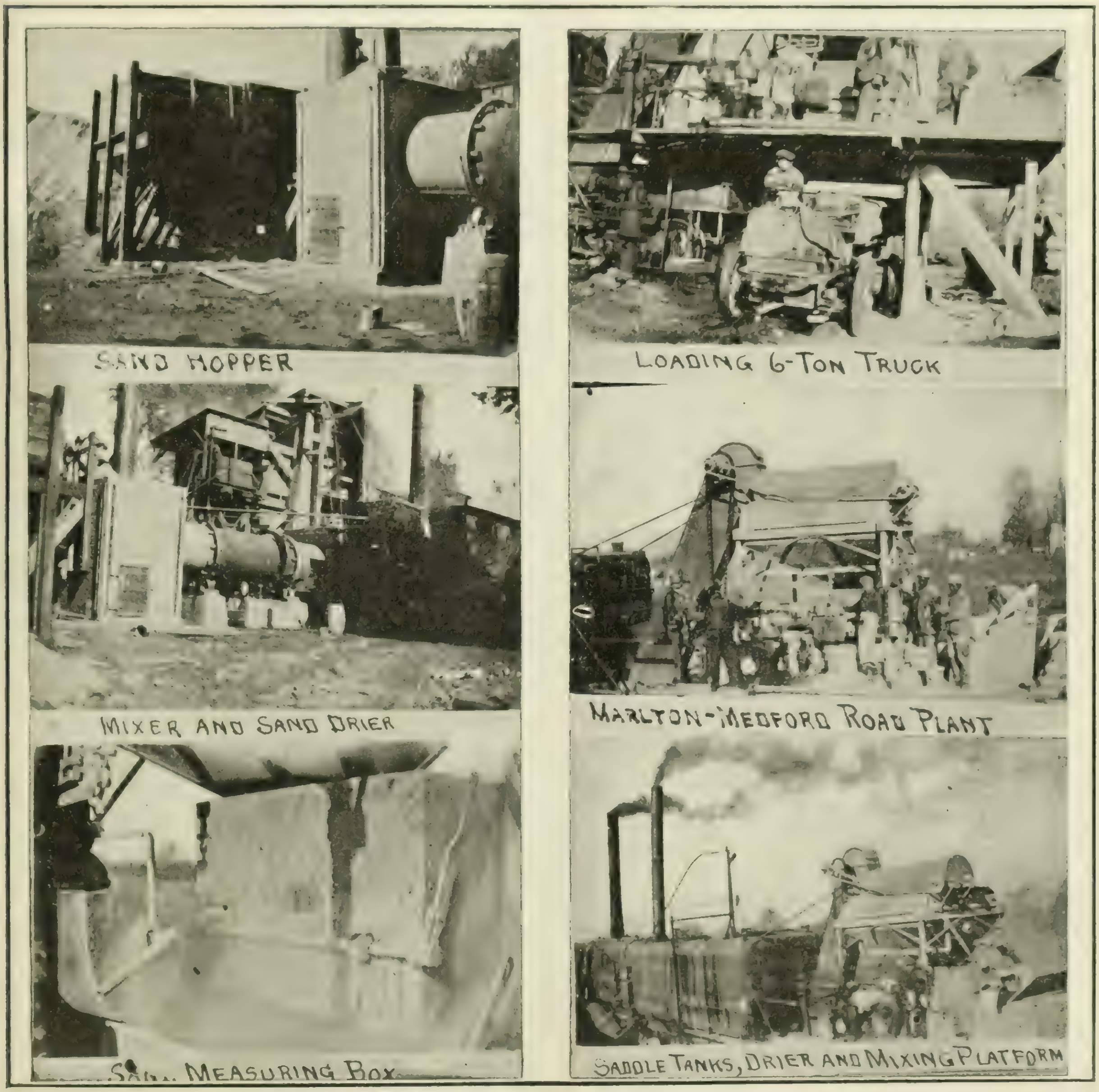
The asphalt, delivered in 25-ton and 40-ton standard gage tank cars, is heated in them by steam for 24 hours until it is sufficiently liquified to be pumped by air pressure into two 50-ton tanks furnished with steam coils which maintain the temperature of the asphalt there at 300 degrees. From these tanks the asphalt is again elevated by an air lift to an overhead draw-off still, whence it flows by gravity to the mixing platform and is drawn as required into a 200-pound trolley bucket passing over the weighing scales to the charging hopper.

Below the mixing platform there is installed a 15 cubic foot capacity Iriquois pug mill type of mixing machine elevated 12 feet above the surface of the ground and capable of turning out a 2,000-pound batch of binder or top course in from 50 to 90 seconds.

For making the binder course, the proper amount of hot stone is first drawn into the weighing hopper and weighed, then hot sand is weighed into it, and finally the proper amount of asphalt is added and the whole is mixed and discharged by gravity into a truck on the ground below.

For making the top course, sand, stone and dust and asphalt are successively weighed into the hopper, mixed and discharge like the binder course.

The plant, which has a capacity of 3,000 square yards of 3-inch asphalt pavement in 10 hours, is operated by a total force of about 20 men, under the supervision of H. B. Smith, resident engineer, of the firm of Dow & Smith, consulting highway engineers, which since 1916, has inspected the asphalt for about 500,000 square yards of sheet pavement built for James Logan, engineer of Burlington county. The asphalt plant is installed, owned and operated by the Union Paving



MACHINERY AND OPERATIONS AT CENTRAL ASPHALT MIXING PLANT
Marlton-Medford and Saddle Tank views are of a portable plant with capacity of 1800 yards daily

DAILY REPORT OF INSPECTOR AT PLANT
County of Burlington, N. J.

Plant of Union Paving Co.

Street: River Road From: Union Landing Road To: Pompestan Creek

Foundation: Re-surfaced Macadam Binder: 1½ in. Surface: 1½ in.

No. of Boxes of Binder: 114 Equivalent to: 1208 sq. yds.

No. of Boxes of Surface: 188 Equivalent to: 1992 sq. yds.

ASPHALT CEMENT

	ASPHALT	FLUX	PENETRATIONS
Kind and No.:	Atl. Ref.	....	48
Binder:	100 lbs.	....	....
Surface:	100 lbs.	....	....

BINDER

	STONE	SAND	ASPHALT CEMENT
Box Weights:	1205	315	80

SURFACE

Sand, kind and proportions: Norcross & Edmunds.

Filler, kind and proportions: Limestone.

FORMULA	SAND	STONE	FILLER	ASPHALT CEMENT	TOTAL	% BITUMEN
Box Weights:	1205	....	215	180	1600	11.2

	TIME	SAND & STONE SIFTINGS									TEMPERATURES
	SAMPLED	200	100	80	50	40	30	20	10	8	SURFACE
Hot Sand:	7:00 A.M.				Binder						290
Hot Sand:	10:00 A.M.										275
Hot Sand:	2:30 P.M.	1	16	10	26	14	11	11	10	1	315
Hot Sand:	4:20 P.M.										300

Remarks: Laid June 19, Binder 1720; Top 1440.

Report No. 31 June 22, 1920 H. B. Smith

Samples of Paving Materials from Plant of Union Paving Company, Hartford, N. J.

REPORT OF ANALYSES

Analysis No. 17928—Asphalt Cement No. 31 Burlington Co., N. J., River Road 6-22-20, Atl. Ref. 100-0.

Analysis No. 17929—Surface Mixture No. 31. Burlington Co., N. J., River Road, 6-22-20, 1205-215-180.

Analysis No.	17928	17929
Penetration of A. C.	50	
Penetration of A.C. at Plant	48	
Ductility	100+ cms.	
Fixed Carbon	16.0%	
Mineral Matter	0.1%	
Organic Insoluble	0.1%	
Bitumen	99.8%	11.5%
Passing 200 mesh		10.5%
Passing 100 mesh		16.0%
Passing 80 mesh		11.0%
Passing 50 mesh		17.0%
Passing 40 mesh		13.0%
Passing 30 mesh		7.0%
Passing 20 mesh		6.0%
Passing 10 mesh		8.0%
Total	100.0%	100.0%

Remarks

No. 17928: This is a good quality Mexican asphalt cement suitable for paving purposes, and complies with the requirements of the specifications.

No. 17929: This is a satisfactory mixture and complies with the specification requirements.

DOW & SMITH.

Copies to Messrs. Logan, Gage and H. B. Smith

Company which maintains there a small field laboratory for testing samples of all materials mixed and all shipments received.

The resident engineer makes daily reports of analysis of the paving materials and the inspector makes daily reports of the amounts of binder and top course mixed, together with proportions of mixture, and the size and temperature of sand as recorded 4 times a day.

The road program of the state of Maine contemplates the expenditure of $4,000,000 and the ultimate completion of an 880 mile system of macadam roads. A $2,000,000 highway bridge from Portsmouth, N. H., to Kittery, Maine, was opened for bids early this month.

The State Highway Department of Pennsylvania on June 15th and 16th received bids for work on twenty-one different sections of road, but announced a month later that all but seven of these had been rejected, most of these seven being projects for borough streets in which the borough concerned will join in the payment. This is explained by the department as due to scarcity of material and even more because of inability of contractors to secure shipments of material, wherefor additional awards would only create further demands for materials and increase these difficulties.

Regulating Traffic in Wilson

Situated in the very heart of the rich tobacco region of North Carolina, the small city of Wilson probably has more automobiles in proportion to its population than any other city in the southeast—possibly in the entire east. In this center of a region where, for the past few years, money has been so plentiful that the appetite for automobiles and other up-to-the-minute devices for spending money has been almost insatiable, the problem of traffic control was a real one. Fines had little effect; accidents were numerous.

Some months ago a new scheme was adopted. "Stop" lines were painted at every street intersection, on each street at the building lines of the intersecting street. This was merely a white line, broad and heavy. At this line every car or other vehicle is required to come to a full stop, before proceeding across the intersection, whether making the turn or going straight ahead.

At first it was feared that congestion might result, but this was not the case, though some very heavy traffic has been handled. Among the advantages of this system are the complete protection of the pedestrian, since every car comes to a stop, and the practical elimination of all crossing accidents. Another result has been the material reduction in speeding offenses, since it is very difficult to get up to an illegal speed between crossings. The enforcement of this is very easy, as the determining factor is not speed, carelessness or right of way, but merely the making of a full and complete stop at the line.

According to the chief of police, traffic accidents and arrests for violations of traffic law have been reduced 50 to 70 per cent, while accidents to pedestrains crossing at the regular crossings have been virtually eliminated. So satisfactory has this system been, that other towns nearby are putting it in force.

Kansas City Wants Water Works Improvement

Kansas City is in urgent need of an improved and enlarged water supply, but finds itself financially unable to obtain it because of the debt limit imposed by the state laws. A campaign has been begun to secure an amendment to the constitution permitting the city to issue bonds up to 10 per cent of the total property valuation instead of the present limit of 5 per cent. The amendment also would permit the city to issue bonds against the water works property up to 20 per cent of its value, which value is estimated at about $20,000,000.

Unless this amendment passes it is not apparent how the city can possibly carry on the work which is needed and the cost of which is estimated to be about $6,000,000. One suggestion made is that the municipal plant be turned over to a corporation, which corporation could bond the plant (this being permitted by private companies), make the improvements, and then turn the plant back to the city. Whether the courts would permit this method of evading the intent of the law might be questioned.

Field Stones for Concrete Roads

Work was started in 1919 on a concrete road between Reno and Carson City, Nevada, a section of the Lincoln Highway, in connection with which there developed great difficulty in securing aggregate. In fact, the contractor was able to obtain only sufficient for 900 feet of road and then abandoned the contract.

The work was then taken over by state highway engineer, C. C. Vottrell. His first step was to endeavor to solve the problem of aggregate supply. The state arranged to purchase the output of a crushing plant and quarry owned by the city of Reno, reorganized work at another quarry which had been operated by the original contractor, and also operated the county quarry. These three sources enabled them to obtain sufficient aggregate to finish a little over two miles of road before work was shut down for the winter.

In February, 1920 the bondsman of the original contractor employed another company to complete the work on a cost-plus-percentage basis, the state agreeing to furnish all the aggregates, which work was placed in the charge of J. A. Bishop. Under Mr. Bishop's direction, two portable crushing plants were installed at various places along the route of the new road, and bowlders and niggerheads which had been placed along fences and stored in piles on ranches along the road were collected by state trucks and hauled to the crusher. The crushers were located sometimes in the right of way of the road and at other places in the fields nearby. The crushed stone was hauled to stock piles scattered along the road at intervals in no case exceeding half a mile. Two crushers are being used with a maximum daily capacity of about 60 cu. yds. and an average output of about 50 cu. yds. One foreman is in charge of each crushing plant, with four men feeding the crusher, one man running the tractor which furnishes the motive power, five men loading bowlders into the truck to be hauled to the crusher, and five men drilling and breaking over-size rocks. At one plant two trucks are used to haul bowlders to the crusher and four trucks to haul crushed rock to the stock piles; while at the other plant one truck hauls bowlders and three haul crushed rock. The maximum haul from the crusher to the stock piles is two miles.

This is the first concrete highway in Nevada and the State Highway Department and the contractor are endeavoring to make it a first class job. 1:2:4: mix is used. The road is about 5½ miles long and 18 feet wide.

Constructing Water Supply Works of Winnipeg*

By W. G. CHASE, Chief Engineer, Greater Winnipeg Water Works

Foundations in difficult ground. Heavy inverts for gravity stability, and general invert construction. Arch construction. River Crossing. Trench Work.

FOUNDATIONS

The material encountered in this hundred miles of trench work varied all the way from peat to rock, including soupy clay, waxy clay, the various intermediate mixtures of clay and sand, dry or under water pressure and quicksand, granite and trap rock. By care in location but little rock excavation was necessary anywhere. Each class of soil found at invert grade presented a separate and distinct problem in the effort to obtain a highly resisting trench floor. Dryness was a prime essential and was generally obtained by the methods described above.

Soupy clay was made firm by casting into it broken stone of varying sizes, mostly of rip rap dimensions.

Quick sand was excavated below grade between lines of sheet piling, a layer of stone and gravel was superposed and within this layer the box drain was maintained at its proper grade; thus stone served to prevent the movement of the sand as the water escaped upward from the sand and also provided a foundation satisfactory for the support of concrete maintained dry until set.

In rock cuts a floor of sand was generally placed as the length of each cut was small.

Where the peat beds were found to extend to depths below the grade chosen for the invert of the aqueduct, the trench was widened and the peat was taken out to whatever depth it would extend; sand and gravel was then placed in the bottom of the trench under water and after having been built to about 2 feet above invert grade, it was under-drained and allowed to settle. This bed of sand was then trimmed in the ordinary way and provided a strong foundation.

In the case of flowing clay foundations it became necessary to open the trench wider than for the standard structure, in some cases to build piled foundations and to use a heavily reinforced invert. Great care was necessary in backfilling in such trenches to prevent the transmission of pressures irregularly to the structure.

HEAVY INVERTS FOR GRAVITY STABILITY

Along Snake Lake, which parallels the aqueduct route for two miles near the Intake, and at certain other points, a porous foundation would have been the source of a serious trouble inasmuch as the surface waters would stand higher than the structure itself and the structure when empty would be liable to float. Generally along such locations the material available for backfill was of a peaty nature and light in weight. Precaution was here taken of building a heavily weighted invert; the engineer's judgment was constantly at test as to whether a weighted invert should be considered necessary or not. With a structure 10 feet 9 inches wide inside, the expense of such an invert was very great and was avoided wherever the earth of the trench floor seemed fairly tight. In deciding upon the use of a weighted invert for this purpose the following options were discarded for the reasons set out:

a. Imported backfill of earth—Too expensive.
b. Increased overfill—doubtful of effectiveness and necessarily huge in quantity.
c. Weighted arch or superstructure—not too efficient and would require a very sturdy invert.

The success of the design chosen, and the efficiency of the supervision had, have been proven through the first year's operation as the aqueduct through these locations is still secure in place although frequently far from full of water, and although it has been constantly wholly submerged.

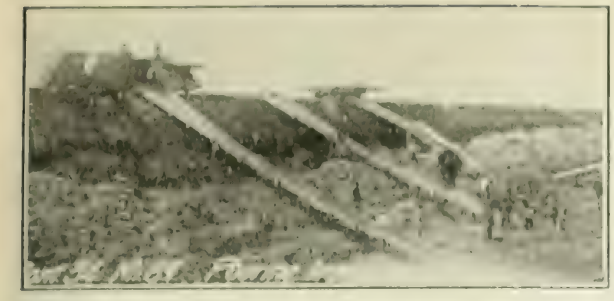
BACKFILLING

The specifications required that between the walls of the trench and the aqueduct the earth backfill should be tamped carefully to a depth of 4 feet. This precaution was taken in conjunction with a moderately light design of arch, which arch, however, was quite safe against pressures of earth backfill even without packed earth at the haunches. In cuts wholly in muskeg it was impossible to carry out such a specification. In a few cases a slight addition to the thickness of the arch haunches was provided but generally the only precaution taken was the deposition against each haunch of imported sand and gravel to the depth prescribed.

The backfill was then completed with machine, generally the machine used by the contractors for the excavation of the trench. It was piled to a depth of 4 feet upon the crown in the case of solid earth, or of 5 feet in the case of peaty material. The minimum width of backfill top prescribed was 8 feet or where that was exceeded by the clear inside width of the aqueduct, then that greater width became the governing dimension for the top of the backfill. The side slopes of backfill were one and three-fourths horizontal on one vertical, which proved to be satisfactory. The only modification made in these side slopes was along Snake Lake where high waters of the lake would rise upon the face of the slope; here the slopes were made three horizontal on one vertical.

The backfill was grassed over with a selected mixture; very heavy sowing of seed assuring a thick bottom on moist soil and insuring a catch on the driest sections. The seeding operations included the removal and burning of stumps and

*Continued from Page 96.



CHUTING CONCRETE TO INVERT

other combustible rubbish, removal of stones, trimming and crowning of the backfill and the raking and rolling of the seed bed. This backfill was thoroughly stirred up with specially designed harrows built to hold themselves on the summit of the dump; no rolling was done but the seed was well buried, a shelter crop of grain being planted at the same time.

CONCRETE MAKING

Throughout the work of aqueduct construction control of the mixture of sand and gravel was maintained by the District's engineers through careful inspection and direction of the operation of the District's own gravel pit where the excavation, screening and re-mixing of the sand and gravel was carried on, producing a uniform concrete aggregate with the desired proportions of sand and of dust. It must be remembered the prime objective in the manufacture of concrete for this conduit was water tightness with economy in the consumption of Portland cement.

This material when dry weighed about 120 to 125 pounds per cubic foot or with 4 per cent moisture, a common condition, 110 to 112 pounds per cubic foot. About 29 cubic feet of aggregate was sufficient to build one cubic yard of concrete in place, allowing for all waste both of aggregate and of concrete.

The average consumption of Portland cement was 1¼ barrels per cubic yard for all work in the 100,000,000 gallon section of the water supply scheme—the easterly 85 miles. The consumption of Portland cement in the pressure pipe of the Red River Valley Siphon was about 2 barrels per cubic yard in a mixture averaging about 1 bag of cement, 1½ cubic feet of sand and 2½ cubic feet of gravel not over 1¼ inch in diameter.

BENDING STEEL FOR INVERTS

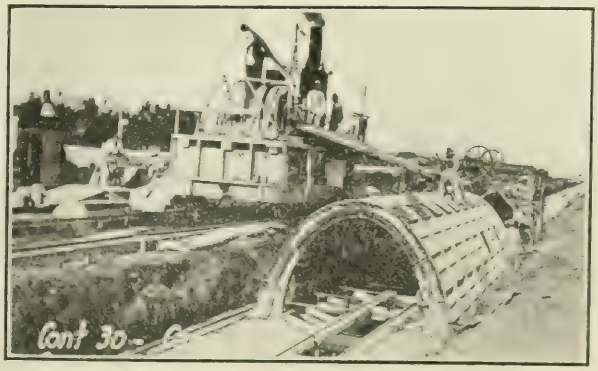
POURING ARCH FROM CONCRETE TOWER
INVERT CONSTRUCTION

Generally speaking the invert of the aqueduct was laid in pads of 15 foot lengths, alternate pads being first laid and when these were hardened the closures being placed. The process of invert making included the placing, tamping and screeding and the floating and trowelling of the surface exposed to water flow. The shoulder was built to a level plane at the chosen elevation, its inner margin being about one inch within the wall of the arch at the foot thereof. This practice afforded a clean and definite line of intersection between the inner surfaces of the arch and the invert. Into the green concrete of the shoulder a thin wooden strip was placed and bound by the setting concrete. After the concrete had been set and before it became hard this shoulder was brushed with wire brushes removing all laitance and exposing the pebbles of the concrete.

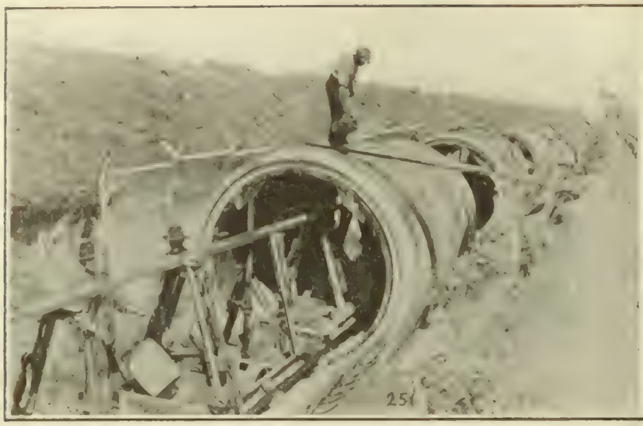
ARCH CONSTRUCTION

The arch was commonly built within 45-foot forms, each set of forms being arranged for transport up and down the trench upon a suitable carriage. The bulkheads were designed to support and to secure the crimped copper strip water stop. As the trench was commonly in shallow cut it was necessary to mix the concrete with some slight excess of water, although the pressence of the fine sand in the aggregate gave a considerable fluidity to the mixture.

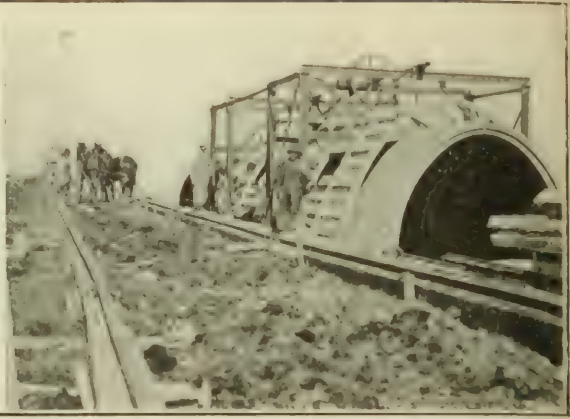
It was, therefore, necessary to carefully work the concrete into place in the form and, after filling the form, to keep adding concrete, at the same time working the material off the surface



POURING ARCH FROM TRAVELING MIXER



REMOVING FORMS AND SPRINKLING ARCH



REMOVING OUTSIDE FORMS

of the crown of the inner form until the material became too stiff for further working. After the first season of construction it was found that this precaution ensured the building of an arch structure without longitudinal crown cracks, a common distressing difficulty in all arch building, especially where the crown is thin and the arch form flat or of large radius.

RED RIVER CROSSING

* * * The easterly four miles of the Red River Valley siphon is a 96-inch diameter by 8-inch wall reinforced concrete pipe, trench built in 15-foot sections and in the standard two portions namely, invert first and superstructure following. The transverse joints were ultimately caulked with a V of neat cement hammered into place. The backfill over this 96-inch pipe and over the other circular pressure pipe at easterly river crossings is 6 feet in depth, it being more important to prevent frost forming within the pressure pipe whose perimeter is entirely wetted, than within the horseshoe section whose crown is never wetted.

Between the Red River Margin and the site chosen for the Water District's Reservoir at Mile 11 the conduit is a 66-inch diameter by 81inch wall Lock Joint reinforced concrete pipe, manufactured at a central point and in 8-foot lengths, transported to the trench on railway cars and laid and jointed in the trench, the jointing not being done until the pipe had been covered to a depth of 1 foot with earth and had obtained a uniform temperature.

TRENCH WORK

This trench was very interesting. The contract provided for vertical payment lines and the contractors decided that for convenience in operations those payment lines must also be the construction lines. The first operation was to drive twenty foot round wooden piles along each side of the trench and at intervals of 2½ to 4 feet. These piles afforded support for the steam shovel with which the earth was removed from the trench and also insured that the berm of the trench should be firm and capable of supporting the machine with which the heavy pipes were lowered into the trench. The entire process of excavating, pipe laying and preliminary backfilling was confined within a distance of less than 500 feet as a rule. Backfilling to a depth of 1 foot above the pipe followed immediately after the laying of the pipe to line and grade and the building of supporting haunches of plain concrete alongside the pipe. The trench wall piling was then withdrawn and the piles were carried forward for second use.

This Red River Valley siphon passes through a soil bed whose sea-deposited clay is heavily impregnated with sulphates of sodium, of magnesium and calcium and bearing occasionally some other salts. To prevent reaction of these salts in ground waters upon the reinforced concrete pipe, this trench, from Mile 13 to the Red River, and its extension through the city of Winnipeg from the Red River to the city reservoir, was thoroughly underdrained.

An 8-inch vitrified tile was laid with open joints along the lower corner of the trench, and, after the shoulders or haunches of the concrete had been built alongside the pipe in place, a backfilling of coarse gravel was placed nearly to the top of the shoulders and insured the collection of water seeping from the trench walls and its delivery to the drain tile.

Similar methods of construction were applied to the 48-inch diameter by 6½-inch wall reinforced concrete Lock Joint pipe line laid from the west shaft of the Red River tunnel to the City of Winnipeg reservoir on Logan avenue, a distance of 2.3 miles.

To be concluded

Great Lakes-St. Lawrence Waterway

After discussion by a largely attended and enthusiastic congress to consider the subject of a waterway connecting the Atlantic with the Great Lakes, the congress on July 25 adopted a resolution urging the United States Congress to act quickly with a view to the construction of such water-way. A telegram was received from Herbert Hoover urging that the construction of the proposed water-way be under the direction of a single public works department organized to replace the various bureaus and departments doing Federal work, which latter feature has already been urged upon congress by numerous organizations.

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The Federated American Engineering Societies

There was held in Washington, D. C., on June 3rd and 4th, a conference of representatives of 71 engineering and allied technical societies, the purpose of which was to organize a federation of such societies "to further the public welfare wherever technical knowledge and engineering experience are involved and to consider and act upon matters of common concern in the engineering and allied technical professions."

The conference adopted a constitution and by-laws providing for "The Federated American Engineering Societies," to which any national, district, state or local society or organization of the engineering or allied technical professions may be admitted by vote of the American Engineering Council. The members of this council, in which is vested the management of the organization, consist of representatives of the member societies, one for each thousand members or major fraction thereof. Each national society shall pay to the F. A. E. S. as dues $1.50 per year for each of its members, and each district or local society $1.00 per member. The expressed aim and purpose of the society is that given in the quotation above.

All societies qualifying for membership are invited to become charter members of the F. A. E. S., and appoint delegates to the first meeting of the American Engineering Council, to be held in the fall of this year, the exact date of which has not yet been decided. Meantime the organization is being represented by the "Joint Conference Committee" of the "big four"—the A. S. C. E., the A. I. M. E., the A. S. M. E., and the A. I. E. E.

Probably the first question that will occur to societies when considering membership in the federation will be that of the dues. The American Water Works Association has over five thousand members, its dues were $5 a year, but it was found necessary to raise these to meet expenses, and this will be voted on next year. The American Society for Municipal Improvements has about 600 members. Its dues are $5, and last year its expenditures exceeded its income by about $475.

The New England Water Works Association has about 900 members. Its dues are $4. The Louisiana Engineering Society has about 275 members, the dues are, we believe, $10, but the expenditures in 1919 exceeded the receipts by about $400.

These societies are the only ones of which the figures are convenient to our hand, and are probably typical. All undoubtedly hope that their expenditures will fall (they are largely for printing, and we see no signs yet of any decrease in them), but meantime we question whether, in view of a deficit last year, the A. W. W. A., will feel justified in adding $7,500 to its expenditures, the A. S. M. I., $900, the N. E. W. W. A., $900 and the L. E. S., $275. In each case this would probably necessitate raising the dues by the $1.50 or $1.00 required for membership in the federation, and this in turn would require a constitutional amendment at the next annual meeting. It does not, therefore, seem probable that many organizations can join the federated societies until after their members have voted to increase the dues for this purpose, except such (if there be any) as have already so voted.

The four leading societies have a combined membership of about 35,000, which will give an income of about $52,500. If most of the eligible societies should join, the income would probably exceed $150,000. This would be sufficient for carrying out quite ambitious projects. The question suggests itself, however, whether it would not be better to begin on a smaller scale, with dues that would not at the outset frighten off the scores of smaller societies which are just now struggling to meet their present expenses.

Specifications for Converting Macadam To Sheet Asphalt Roadway

The highway program of Burlington county, N. J., provides for the conversion, during the years 1919-20-21, of 60 miles of water-bound and oil-treated macadam to wider sheet asphalt pavement on the original foundation. About 40 miles will have been completed by the end of the present season at a cost that has increased from about $1,000 per mile last year, to $1,500 per mile this year. All of the work is done by contract as described on page 133 of Public Works, August 7, and the asphalt for the binder and top courses was mixed at the contractors central plant described on page 146 of this issue of Public Works.

The construction, reconstruction, maintenance and all other road work in Burlington county has been designed and is executed under the supervision of James Logan, county engineer, under a standard form of specifications, bids, contracts, bond, and other necessary documents which, being bound together and endorsed with the file number and contract number, provide a complete record of the work and give unusually concise and comprehensive data for official purposes and for the use of the engineers, inspectors and contractor, who find there all essential information properly arranged and the sequence and details of different operations clearly presented.

The front cover gives the route, location and name of the road, the chapter and section of law under which the contract was awarded and the contract and specifications were submitted and approved. The specifications are preceded by a description of the road and its history, and are divided into three parts, covering the widening and resurfacing, the surface, and the details.

The usual definitions and general clauses relative to rights, duties, and requirements, are supplemented by specific descriptions of the methods and requirements provided for widening the road, scarifying, crowning and rolling, broken stone course, binder course, shoulders, watering and rolling the old macadam in the preparation of the foundation for the sheet asphalt. These are followed by a general description of the sheet asphalt surface with paragraphs specifying the materials, methods of testing composition of refined asphalt and asphalt cement, fluxes, and their physical properties and those of the binder stone, sand and filler; these being practically the standard specifications of the American Society for Municipal Improvements.

The specifications are followed by a proposal blank ready for the items to be filled in, and signed by the bidder; by certificates approving the designs, specifications, proposal and contract, which are signed by the engineer and solicitor; by a certificate of approval of materials, drawings and calculations signed by the division highway engineer; and by an approval of the specification and order to advertise which is signed by the clerk, by the assistant state highway engineer, and the chairman of the state highway commission.

There is an affidavit as to publication and notice signed by the clerk and notary; a report on bids received, signed by the presiding officer and clerk; a report on bids opened, signed by the solicitor and engineer; an approval of equipment signed by the engineer; and a tabulated summary of bids giving the percentage of the engineer's estimate of cost for each bidder on the different items of quanities and price.

There is a certificate of the award of contract signed by the clerk, and the contract itself signed by the chief clerk and the bidder and witnesses.

There is also a form for the surety corporation bond, approved and signed by the director of the surety company and by the finance committee. There is a certification as to funds applicable to the contract signed by the bookkeeper, recommendations for approval signed by the state highway engineer, and the approval form signed by the chairman of the state highway commission.

Standby Power Plants

Power plants using hydraulic power where a considerable percentage of the ordinary capacity of the stream is utilized find it necessary to provide standby plants. These have sometimes been for operation by steam, and sometimes by internal combustion engines—gasoline or oil. Not so common is it for those using steam to provide an alternative power.

But with the possibility of a coal shortage ahead and recurring annually, it would seem to be the duty of those furnishing power for water, light, transportation, or other public utilities, to consider whether they should not provide themselves with a standby equipment using neither coal nor waterpower; and others to whom a shutdown would involve great loss might well find this to their advantage also. An electric equipment depending upon either of these as its source of power would not, of course, serve the purpose; and gasoline or oil, or natural gas where this is available, would seem to be the only sources of power that would meet the conditions.

Heretofore that coal could not be had in any quantities desired and with delay of a few days at the most, was almost unthinkable, and a duplicate coal-burning plant was a satisfactory safeguard against interruption of service. But with coal mining and transportation conditions in so unsatisfactory and unsettled a state, the above suggestion is forced on our attention.

La Grande's Water Supply

A few weeks ago a report was submitted to the City Council of La Grande, Ore., by Louis C. Kelsey, as consulting engineer, relative to an improved water supply.

Three propositions were reported on, one providing for a 22-inch pipe line, 44.8 miles long and costing $1,865,220; the second an 18-inch wood-stave pipe line, costing $879,473, or an alternate line following the same route but using a 20-inch wood-stave part of the way and a 16-inch vitrified pipe the remainder of the way and costing $831,486. The two latter propositions contemplate a dam which would cost about $150,000. The third plan contemplates replacing an existing pipe line with one consisting of 12-inch and 14-inch steel pipe and 18-inch wood pipe, and the construction of a new dam.

The estimates are based on an assumed consumption of 6,000,000 gallons a day, or 300 gallons per capita for a population of 20,000.

The second of the two plans is the one recommended by Mr. Kelsey.

Seattle Water Supply Delayed

The construction of the proposed $3,000,000 68-inch steel pipe line forming part of the improved water supply for the city of Seattle, Washington, has been delayed by the failure to authorize the expenditure of $3,600,000, the amount of the lowest bid for the construction of the eighteen mile line. It is believed that by waiting until next winter a saving of $350,000 can be accomplished in the cost of the steel, and that the bond market may also be improved at that time.

St. Louis Building Sewer By Force Account

Because the appropriation was not quite large enough to cover the lowest bid for 4,500 linear feet of the 12-foot and 3,000 feet of the 6 to 8-foot South Harlem sewer in St. Louis, which the contractor offered to do for $382,000, a sum that was considered well balanced and reasonable, the city is organizing a special section under the division of sewers and paving, and will do the work by force account under charge of W. W. Burden, engineer of construction, and W. W. Horner, chief engineer.

Hannibal Municipal Water and Light

No part of the general taxes of the city of Hannibal, Mo., has been used for the support of the electric light plant of that city or for the payment of bonds or interest since the management of the plant was placed in the hands of the Board of Public Works in 1903; and the same is true of the water works plant, acquired in 1913. On the other hand, the plants have furnished without charge street and white way lighting and fire hydrants, which are estimated to be worth, for the year ending May 31, 1920, $4,930 for lighting and $7,750 for fire protection. Also, the plant paid a franchise tax of $4,743, and $907 donated to other municipal departments. Also there was paid from the operating expenses last year $5,421 for extensions and betterments of the water works.

During the year the electric light and power department received from all sources $139,401 and its total expenses for all purposes were $114,263, in addition to $9,350 used for the purchase of Liberty Loan Bonds. Coal expenses for the year for this department amounted to $51,587.

The water department received during the year $61,925, and the total operating expense, including new construction and interest, was $56,185, of which $9,494 was for coal. The water works was purchased from a private company in 1913 for $301,347, bonds being issued for $360,000 to cover purchase price and improvements; and since then $185,000 of the bonds have been paid and cancelled and in addition there has been spent $120,270 for extensions and betterments.

Although production costs have greatly increased during the past few years, there has been no increase in rates for electric light or power or water servvice. For electric lighting the base rate is eight cents per k. w. h., with a 10% discount for a monthly bill of between one dollar and five dollars, 20% for between five dollars and ten dollars and a six cent rate for all over ten dollars. For water service the rates gradually decrease from thirty cents per thousand gallons for 15,000 gallons a month or less, down to eleven cents for all over 600,000 gallons a month; these rates being subject to 10% discount on bills paid before the 15th of the month. There is a minimum net monthly charge of 75 cents for each water meter.

Convincing Council of Desirability of Meters

The water commissioners of Erie, Pa., have been urging the city council of that city to permit them to install meters generally, but without success. Recently they have endeavored to demonstrate some of the advantages which they claim for meters by installing meters in the homes of the councilmen. About the first of July four of the councilmen permitted meters to be installed in their houses and agreed to read the meters and figure for themselves how the cost of water service under the proposed meter rate would compare with the flat rate now being charged. One of the councilmen is reported to have said that he calculates that he would have effected a saving of at least five dollars a year in the past had he been paying by meter rather than flat rate. The water commissioners believe that the experiment will prove to these councilmen their assertions concerning the advantage to citizens of the use of meters, and hope that the council will then reconsider their former action and permit the general installation of meters throughout the city.

Fire Fighting Efficiency of St. Louis Water Supply

The water works system is found by the National Board of Fire Underwriters to be in very good condition from a fire fighting point of view, only a few minor extensions being recommended.

The National Board of Fire Underwriters has a reputation of being difficult to please when it comes to obtaining its approval of the sufficiency of water supplies as agents for fighting fire. It may, therefore, be considered as high praise that it has practically nothing but approval to offer concerning the water works system of So. Louis, Mo. During the first two months of this year engineers of the board made a thorough investigation of the water works of the city and in a report published in July give a very complete description of the entire system as it was at that time.

A previous inspection had been made in 1912 and since then a number of important improvements had been made, the chief of these being a new intake with ports at a lower elvation than those in the old intake, and an 8-foot tunnel extending to the Chain of Rocks pumping station; a 1000,000,000 gallon low-lift centrifugal pump in this station; a filtration plant with a nominal capacity of 160,000,000 gallons a day; a reinforced concrete conduit 6.5 by 5.96 feet between Baden and Bissell's Point; new pumping plant for the Bissell's Point pumping station; enlarging the Competon Hill reservoir; adding 97 miles of pipe to the distribution system, and installing about 5,400 modern type hydrants.

Summing up the results of the investigation, the engineers arrive at the following conclusions:

Organization. The officials of the water division are well qualified for their duties and the number of employes is ample.

Records. Plans and records are complete.

Emergency Operations. Fire alarms are received in three water works quarters and emergency operations are good.

Source of Supply. An inexhaustible supply is available from the Mississippi river.

Intakes. Two substantial masonry intake towers, one located at the deepest point of the channel, with adequate inlet ports well below low water. The probability of interruption of supply from floating ice or shifting of channel is slight. Tunnels to low-lift pumping station are of ample capacity. Good facilities are provided for handling slush ice in the wet well.

.Pumping stations. Pumping capacity at the low-lift station is ample and at the high-lift stations is satisfactory for present needs in view of the numerous large emergency connections between the High and Low services; excellent records of closed gates and good emergency provisions; the 40,000,000-gallon pump, capable of operating on either service, proposed by the water division, will add to the reliability. Boiler capacity is adequate and all equipment is in good condition except some of the old boilers, which are usuable. Steam piping is well laid out and installed, but additional valves would be of advantage at the low-lift station. At least thirty days' supply of coal always on hand. Suction and discharge piping generally well arranged. The stations, although of substantial construction, in good condition, and with well guarded hazards, are not of fireproof construction, the various sections are not cut off by fire doors and the different buildings of the plants are mutually exposing. The inadequate private fire protection in all and distance of the low-lift pumping station from the nearest fire station may lead to serious interruption from fire.

Filtration Plant and Storage Reservoirs. The total available content of the various basins and chambers at the filtration plant and the storage reservoirs at Baden and Bissell's Point is 286,000,000 gallons, or nearly twice the maximum daily consumption. Filters, with suitable allowance made for units out of service for cleaning, are of adequate capacity for present needs. The various units of the filtration plant and the storage reservoirs are well arranged and can be by-passed through many emergency connections.

Main Supply Conduits. Main supply conduits are now in duplicate from Chain of Rocks to Bissell's Point; the probability of interruption of supply from the failure of a conduit is slight.

Distributing Reservoir. Advantageously located, well constructed and at an elevation to give good pressures in the congested value district; contains one day's average consumption on Low service and ten hours' fire flow.

Consumption. Consumption is moderately high and is steadily increasing; it can be materially reduced by the general installation of meters, as has been frequently demonstrated under similar conditions in other cities. Such reduction in the consumption would defer for years the heavy expenditures involved in obtaining a new source of supply, which the present rate of consumption will soon make necessary, as well as increase fire protection in all parts of the city.

Pressures. Pressures are well maintained at the pumping stations and in the congested value district. During periods of extreme consumption, pressures in the High service and in the southern part of the Low service are greatly reduced and in a few places are too low to furnish good fire engine supply.

Protection. Reasonable protection for the congested value district requires a fire flow, in excess of maximum domestic consumption, of 12,000 gallons a minute, with a distribution system capable of delivering this amount about any block, and with hydrants so located as to deliver two-thirds of this quantity upon any large fire through hose lines, none exceeding 600 feet in length; in addition the arterial system should be capable of delivering 8,000 gallons a minute for a second fire. The total quantity includes an allowance for loss from broken service connections and hydrants left open incidental to a large fire. In manufacturing and minor mercantile districts, 5,000 to 10,000 gallons are necessary. Closely built residential sections of 3-story and higher buildings require 3,000 to 5,000 gallons, and in outlying residential districts a minimum of 1,500 gallons is needed. Fire flow tests showed that these quantities are generally available under ordinary consumption conditions, but that increased consumption in extremely warm or cold weather would leave insufficient quantities in some parts of the south end of the city, in the high portions of the High service area, and where the gridiron consists of long lines of 6-inch mains.

Mains. Main arteries and secondary feeders form a system which is generally well arranged, well looped and of adequate strength; High service arteries are very long and show a high friction loss at times of extreme consumption. Minor distributers are fairly well gridironed in the closely built parts of both services, but in a number of localities of recent development there are many 6-inch mains of excessive length between cross-connections; dead ends are not particularly numerous. The oldest mains are badly incrusted. Several important mains have recently been damaged by electrolysis.

Gate Valves. The system is fairly well equipped with gate valves in all parts of the city. Valves are systematically inspected and maintained in very good condition.

Hydrants. Spacing in the congested value district is excellent and in other sections fair to good. Hydrants recently installed are of a good type but over a sixth of the total number are of the obsolete underground type; only a small proportion have gated connection to main; hydrants are in good condition but considerable trouble is caused by promiscuous use by those not connected with the fire department or water division.

The streets of Twin Falls, Idaho, are occupied by the mains of Elm Park Water Company, and an injunction has recently been issued restraining the city from interfering with the mains of the company; except that the city is authorized to make such changes as may be required by construction work in streets and avenues, but is required to replace the mains without damage to the system. The city proposes to fight in court the company's claim to rights in the city streets.

A Constitution of Industrial Relations

Principles of Industrial Employment Relations, including Open Shop, Right of Association, Production, Wages and Management, Hours of Labor, Government, and Public Service Employment as recommended by the Committee on Labor of the Associated General Contractors' of America.

To promote the establishment of fair and satisfactory practical relations between the employers and employes, study and investigation has been made for the Associated General Contractors' of America by their special committee on labor, Leonard C. Wason, chairman and H. J. Bernnan, Tylor Field, G. O. Muhlfeld, F. W. Smith, and C. P. Waterman, officials of important construction interests in different parts of the country.

Their conclusion is that in the struggle to interpret and to establish relations between employers and employes, there is needed a declaration of principles so basic, so wide in scope, so fair in application, so clear in expression, that it may be accepted as a constant measure of the justice and wisdom of the temporary devices that must be framed to meet fluctuating conditions.

Such a declaration the committee has widely, but unsuccessfully, sought. The closest approach to it they have found in the Statement of Principles enunciated by the Chamber of Commerce of the United States, (February 2, 1920) and included in Referendum No. 31 on the report of the committee on Industrial Relations regarding employment relations (June 9, 1920). This statement is as follows:

The interest of the public, which includes every individual in the community, is paramount. It is composed of interdependent interests whose just balance necessitates that impartial justice be accorded to every individual.

There is a mutuality of interest among employers, employes, and investors. Their interests as well as the public interest must be defined and protected and to this end public opinion must be kept informed and enlightened.

The Employment Relation. Every person possesses the right to engage in any lawful business or occupation and to enter, individually or collectively, into any lawful contract of employment either as employer or employe.

The Open Shop. The right of employer and employe to enter into and to determine the conditions of employment relations with each other (without reference to the affiliation or non-affiliation of either with any organization) is an individual right of free contract possessed by each of the parties.

Right of Association. All men possess the equal right to associate voluntarily for the accomplishment of lawful purposes by lawful means. The association of men whether of employers, employes, or others, for collective action or dealing, confers no authority over and must not deny any right of those who do not desire to act or deal with them.

Responsibility of Combinations. The public welfare, the protection of the individual, and sound employment relations equally require all associations or combinations be subject to the authority of the State. As the public interest is paramount, full publicity of facts of industrial relations is necessary.

Obligation to Secure Production. To develop, with due regard for the health, safety and well-being of the individual, the maximum capacity and output required of industry is the common social obligation of all engaged therein.

Wages and Management. The wage of labor must be drawn from the product of industry and must therefore be earned and measured by its contribution to production. All employes are entitled to complete business information in matters affecting the terms of their employment; and frankness is essential. In order that the worker, in his own and the general interest, may develop his full productive capacity, it is the duty of management to assist him to secure regular employment suited to his abilities, to furnish him with incentive and opportunity for self improvement, and to provide proper safeguards for his health and safety.

Hours of Labor. The number of hours in the work day or week in which required maximum output, consistent with the well-being of the workers, can be maintained in a given industry should be ascertained by careful study and never should be exceeded except in case of emergency. One day of rest in seven, or its equivalent should be provided.

Adjustment of Employment Relations. Adequate means satisfactory both to the employer and to his employes, and voluntarily agreed to by them, should be provided for mutual discussion and adjustment of employment relations.

Community of Interest. The greatest measure of reward and well-being for both employer and employe, and the full social value of their service to the public must be sought in the successful conduct and full development of the industrial establishment in which they are associated. Intelligent and practical co-operation based upon a mutual recognition of this community of interest constitutes the true basis of sound industrial relations.

Government Employment. The State is sovereign and cannot tolerate a divided allegiance on the part of its officers and servants. While the right of government employes, national, state or municipal, to be heard and to secure consideration and just treatment should be amply safeguarded, the community welfare demands that no combination shall be permitted to prevent or impair the operation of government or of any governmental function.

Public Service Employment. In public service activities the public interest and well-being must be the paramount and controlling consideration. The power of regulation and protection exercised by the State over the corporation should properly extend to the employes in so far as may be necessary to assure the adequate, continuous, and unimpaired operation of public utility service.

The Committee on Labor of the Associated General Contractors desire the greatest possible publicity and discussion of the foregoing statement. It invites constructive criticism in order to perfect this draft, if necessary.

It is hoped that it may ultimately be widely adopted as the guide for all industrial employment relations.

Immigration in 1913 and in 1920

During the six months from July 1, 1919, to December 31, 1919, the total number admitted was 162,883 and departed 166,212—a net loss of 3,329. In the same six months of 1913 (the last year of our normal immigration), the total number admitted was 734,869, and departed 153,790—a net gain of 581,079. An analysis of these figures by races indicates that in 1913 there was an increase in 39 of the 40 races listed.

In 1919, however, twelve of the races that normally provide the bulk of our unskilled labor supply including Serbians, Greeks, Italians and Roumanians, show a total decrease of 86,102, and six other races that also usually furnish large numbers of unskilled immigrant workers including Russians, Ruthenians, Bohemians, and Lithuanians, show a total increase of only 2,159.

The eighteen races that during this period show an increase of 64,443 including the English, French, and Scotch, do not generally engage in the basic agricultural or industrial work of the country. The Mexicans also show an increase of nearly 8,000, but they were generally admitted under bond to meet the agricultural needs of border states. It has been stated also that more than half of the total number admitted were women and children coming to join members of their families, while practically all of those who departed were adult male wage earners.

During the first five months of 1920, the preliminary figures for the Port of New York (which usually handles about 80% of the total immigration and emigration for the country) show a net increase of 38,288.

Practically all of those who left the United States during these five months were able-bodied male wage earners. Of those who entered, about half were women and children and a large part of the balance were natives of Italy and returning reservists. Many of the men admitted had previously been in the United States and practically all of them had definite destinations and knew exactly where they wanted to go.

Comparatively few new able-bodied aliens are arriving, as a number of the European countries do not yet permit men of military age to leave their borders. Our own war-time passport regulations requiring an American Consul's vise before an alien is allowed to board a vessel, the enforcement of the illiteracy test and the fact that many of the large passenger steamers formerly bringing in immigrants are now out of commission, will temporarily retard a return to the pre-war immigration to the United States.

Prepared from data issued by the Inter-Racial Council.

Our Alert Competitors

Press reports state that exceptional inducements are offered in Peru to European immigrants who, under certain conditions, receive free passage to Peru from any part of Europe, are granted six days free board and lodging after arrival, and free conveyance to any part of the country, besides other inducements.

Evidently the government of Peru realizes the necessity of abundant and reliable labor to develop her great natural resources and has set about securing it in a rational way. In the present distressing conditions throughout Europe, this cannot fail to be alluring to thousands of sturdy peasants who would probably be much more desirous of coming to the United States and would respond to smaller inducements here.

In some countries the war losses are more than counterbalanced by the lack of supplies and capital, and the peasants are and will be encouraged to emigrate. This is probably true in large parts of Germany, Hungary, Bulgaria and perhaps other countries whose undesirables we may well wish on the most remote countries, while there will be an abundance of other and more desirable immigrants knocking at our doors if we only open to them.

Decreasing Efficiency of Labor

From records made of cargo handling at New Orleans on three ships of the Morgan Line, it is shown that in fifteen unloadings in 1914, 7,672 tons of cargo were handled by 20,218 man-hours, about 2.6 man-hours per ton.

Fifteen unloadings of the same ships in 1919-20 with practically the same cargoes and the same workmen showed 7,748 tons handled by 28,638 man-hours, about 3.7 man-hours per ton, showing an increase of 41 per cent of labor and 1 per cent additional tonnage. The number of pounds handled per man-hour has decreased from 793 in 1914 to 547 at the present time showing a loss of 45 per cent efficiency.

In connection with this record it is interesting to note that in 1914 thirty-four claims aggregating $100 were paid for materials stolen from cargoes handled, while in 1920, under the same conditions, there were paid six hundred and fifty-five claims aggregating more than $20,000 for pilfering from the cargoes handled.

Labor Turnover

The monthly labor review of the U. S. Bureau of Labor statistics states that the records of 1908-19 show that work equivalent to the full time (3,000 hours) of one year's labor for 2,117,682 workers involved 5,045,317 labor changes equivalent to considerably more than a complete annual turnover of the working force.

After a month's strike the Brick Contractors Association and Brick Layers Union of Pittsburgh have signed an agreement giving a wage of $1.50 per hour.

Recent Legal Decisions

ROAD CONSTRUCTION CONTRACTORS HELD ENTITLED TO FILE SECOND BOND AFTER BID ACCEPTED

In an action on the bond of a surety company securing a road construction contract, at the instance of a materialman who furnished materials and labor to the contractor, the defense was that before executing the surety bond the contractor had given a bond with personal security, and that the surety bond was unnecessary under the law and void. This case is illustrative of a practice which it seems is becoming common in Indiana —the practice of bidders on public works, for the purpose of saving the premium on the bond in case they should not be the successful bidder, of filing a bond with personal surety and then, if the work for which they bid should be awarded to them, of giving a surety company bond to cover the proposed work, with the idea that such bond, when approved by the board shall in all things take the place of the personal bond filed with their bid.

If it were conceded that there was no legal necessity for the filing of the surety bond, and that the board of commissioners had no right or authority to approve it, the Indiana Appellate Court, Massachussets, Bonding & Ins. Co. v. State, 127 N. E. 223, thinks that it does not necessarily follow that the surety bond is without legal force and effect. If the contractors, after the contract had been awarded to them, for any reason desired to procure a new bond, and thereby relieve their former bondsmen from any liability to answer for their failure to pay for labor and materials furnished to them on account of the construction contract, there is no statute or rule of law preventing such action, or which would render such bond so taken void. In such case, as between the contractors and such new surety, or between such surety and the labor or materialmen, the bond being otherwise sufficient, any action by the board of county commissioners approving said bond would be entirely unnecessary, and as between the parties above named, would in no way change the legal effect of the bond.

It is also held that a surety company cannot avoid liability on such a bond because the contractors failed to pay the premium, nor can the contract be revoked on that account. Judgment for plaintiff was affirmed.

MECHANICS' LIENS—WORK AND MATERIALS FOR PUBLIC LIBRARY

New York Lien Law does not permit the enforcement of a mechanic's lien against the land and building of a municipal corporation. It does permit the enforcement of such a lien against moneys of the corporation applicable to the construction of the improvement. When labor and materials furnished have gone into the construction of an improvement the question may arise whether there are any such moneys to which a lien can attach. Labor and materials were furnished to the builder of a Carnegie Library for a city under contract with a committee appointed by the philanthropist on a site furnished by the city. The New York Court of appeals holds, Bexauer & Lemke v. Luke O. Burke & Sons Co., 127 N. E. 329, reversing 182 app. Div. 924, that the parties furnishing the labor and materials were not entitled to a lien on the balance of the philanthroptist's funds in the hands of the committee, but due the builder, on any theory that in substance moneys owing by the committee were owing by the city. The lien failed for lack of any subject-matter to which it could attach. There was no lien on the building by force of consent to the improvement, for that was a public one on the land of a municipal corporation. There was none on the corporate moneys, for no corporate moneys were applicable to the contract. There was none on the moneys due from the committee to the builder, from one contractor to another for none is given by the statute. Though the building contract gave the committee the privilege of withholding payments from the builder until liens had been discharged, that privilege could not create a lien if none would otherwise exist.

WAIVER BY COUNTY OF NECESSITY FOR CONTRACT BOND

Where a contractor for repairs on a county courthouse did not furnish the bond required by the contract, and there is no requirement that such a bond should be given aside from the contract itself, it is held, Obelisk Waterproof Co. v. Cloher, 11 Misc. (N. Y.) 182 N. Y. Supp. 303, that the board of supervisors, by accepting the bond which was executed, and permitting the contractor to proceed with the work, waived the giving of any other security.

STOP NOTICE STATUTE NOT APPLICABLE TO WORK ON PUBLIC HIGHWAY

The California Supreme Court holds, Slayden v. O'Dea, 189 Pac. 1066, that neither section 1183 nor section 1184 of the California Code of Civil Procedure, providing that, in cases of property which is not subject to lien, the owner shall hold sufficient money to pay the claims of persons serving notice, applies to work on a public street or highway, and that the remedy of materialmen in case of a contract let by the public authorities for street work is upon the personal responsibility of the contractor and his sureties, and in the case of a private contract upon a public highway under section 1191, Code of Civil Procedure. A large part of the work upon public highways in California is done under the Vrooman Act and its amendments. The Supreme Court has recently held that in such cases the stop notice feature of section 1183 did not apply. Adamson v. Paonessa, 179 Pac. 880. That decision was based upon the fact that there was no indebtedness from the owner to the contractor to which the statute could apply.

NEWS OF THE SOCIETIES

Sept. 1-3—MICHIGAN STATE GOOD ROADS ASSOCIATION. Annual meeting, Lansing, Mich. President, P. T. Colgrove, Hastings, Mich.

Sept. 7-10—NEW ENGLAND WATER WORKS ASSOCIATION, Annual convention, Holyoke, Mass. Secretary, Frank J. Gifford, 715 Tremont Temple, Boston, Mass.

Sept. 13-17 — AMERICAN PUBLIC HEALTH ASSOCIATION. Annual convention San Francisco, Cal.

Sept. 20-23 — SOUTHWESTERN WATER WORKS ASSOCIATION, Annual convention, St. Charles Hotel, New Orleans, La. Secretary, E. L. Fulkerson, Waco, Texas.

Oct. 12-14—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. St. Louis, Mo. Secretary, Charles Carroll Brown, 401 Lincoln Avenue, Valparaiso, Ind.

Oct. 19-22—INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. 25th annual convention, New Orleans, La. Secretary, C. R. George, Houston, Texas.

Jan. 25-27, 1921—THE AMERICAN WOOD PRESERVERS ASSOCIATION. Annual convention. Place to be announced.

CONNECTICUT ASSOCIATION OF CIVIL ENGINEERS

The annual summer outing of the Connecticut Society of Civil Engineers was held at New London, Connecticut, August 11. The program included a steamboat trip to the Groton Iron Works where the society witnessed the launching of the 9,400-ton steam freighter Hopatcong and were entertained at luncheon.

Afterwards the society and their guests, Gen. W. Goethals and Capt. Frank T. Cable, master of the Holland, the first successful submarine, and builder of the submarine Fulton, visted the U. S. Submarine Base where they were received by Commandant Capt. Oliver, U. S. N. At the base the visitors witnessed a baseball game by their own nine and that of the officers of the base. An inspection of the new railroad draw bridge over the Thames river and the state highway bridge converted day's outing.

CHAMBER OF COMMERCE OF THE UNITED STATES

The result of the referendum vote of the Chamber of Commerce of the United States on the twelve principles of industrial relations embraced in the questionnaire recently issued has been their approval. It has also approved the prohibition of strike by public utility employees and favors legislation providing tribunals with power to enforce adjudication on differences between public utility corporations and their employees.

These recommendations upheld open shop, universal right to engage in any lawful business or occupation, collective bargaining, and the paramount consideration of public interests.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS

The 25th annual convention of the International Association of Municipal Electricians, will be held at New Orleans, La., Secretary, C. R. George, Houston, Texas. The date will be announced later.

LITTLE ROCK ENGINEERS CLUB

At a meeting held July 24 the Little Rock, Arkansas, Engineers Club voted to petition the next legislature to pass a bill appointing an examining board and requiring that engineers should be examined and licensed.

FEDERAL POWER COMMISSION

The federal power commission has divided the United States into five adminstrative districts with headquarters in Washington, St. Paul, St. Louis, Denver and San Francisco.

The work of the commission will be classified as engineering accounting, statistical, regulatory, licensing, legal and operation.

PROBLEMS THAT CITIES ARE STUDYING WITH EXPERTS

Minneapolis, St. Paul, and the University of Minnesota are endeavoring to secure priority of license to utilize the power generated at the federal high dam in the Mississippi River between St. Paul and Minneapolis. Mayor L. C. Hodgson of St. Paul, Major J. E. Meyers of Minneapolis and Fred B. Snyder, president of the Board of Regents of the University of Minnesota form the Board of Municipal Electric Corporation which will present the plea as soon as the Federal Power Commission is organized.

If the license is granted, the municipal electric corporation will install a POWER PLANT at the dam, an electric distribution system to develop and dispose of from 15,000 to 20,000 horsepower, sufficient to supply all the needs of the state university besides affording power for municipal works in St. Paul and Minneapolis.

PERSONALS

Cadwalader, W. S. superintendent of streets, Trenton, N. J. died July 17.

Piper, R. B. city engineer of Medicine Hat, Alta., died July 19th.

Leland, O. M., has been appointed dean of the College of Engineering and Architecture and the School of Chemistry of the University of Minnesota.

Joyner, F. H., has resigned as county road commissioner of Los Angeles, Calif. to accept the position as consulting engineer for corporations in Los Angeles.

Jones, G. W., has been appointed road commissioner of Los Angeles County, Calif.

Neeson, J. H., has been made acting head of the Philadelphia Bureau of Highways.

Johnston, J. H., has been appointed superintendent of highways, Providence, R. I.

Mackall, J. N., has been appointed chairman and chief engineer of the state road commission, Maryland.

Costello, J. W.., has been appointed head of the division of streets, Newark, N. J., in charge of repaving and maintenance of streets, street regulalation, and street cleaning and refuse collection.

Hines, Brig. Gen. Frank T., has been appointed chief engineer of the recently created inland and coastwise water way service of the U. S. War Dept.

Heman, August, mayor of University City, Mo., and president of the Heman Construction Company, St. Louis, Mo., died July 15.

Terrill, E. J., has been appointed resident engineer, Federal Aid Road Project No. 37, Independence, Kansas.

Glaeser, Frederick, has been appointed landscape engineer and superintendent of parks, Trenton, N. J.

Ford, Geo. B., has been appointed director of the city planning department of the Technical Advisory Corporation, New York City.

Barthlomew, Harland, has been appointed consulting engineer for drafting a zone law for Washington, D. C.

Ford, George B., has been appointed director of the City Planning Department of the Technical Advisory Corporation, 132 Nassau St., New York. Also, he has recently been retained as advisor on foreign housing to the U. S. Senate Committee on Reconstructino and Production. Mr. Ford has recently completed a long engagement in France where he was city planning consultant to many of the cities of the devastated areas, including Rheims, Arras and Soissons.

Preble, S. E., has been elected vice president and general manager of the Industrial Planning Corporation, Buffalo, N. Y.

Forbes, Hyde, has opened an engineering office in Los Angeles.

Fredenhagen, B. B., has been appointed resident engineer, Federal Aid Road Projects 44 and 45, Salina, Kansas.

Wenger, E. C., has been appointed resident engineer, Federal Aid Road Project 22, Garden City, Kansas.

Schwab, J. E., has been appointed city engineer of Alton, Ill.

Verharen, A. W., has been appointed city engineer of Helena, Mont.

Ferguson, H. F., has been appointed chief sanitary engineer of the Illinois Department of Public Health.

Garrett, Geo., has been appointed city manager of LaGrange, Ore.

Focht, John A., has been appointed engineer of Rockwall County, Texas.

Montgomery, Julian, has been appointed city engineer of Wichita Falls, Texas.

Clark, W. H., has been appointed consulting engineer to the highway department of the state of New Jersey.

New Appliances

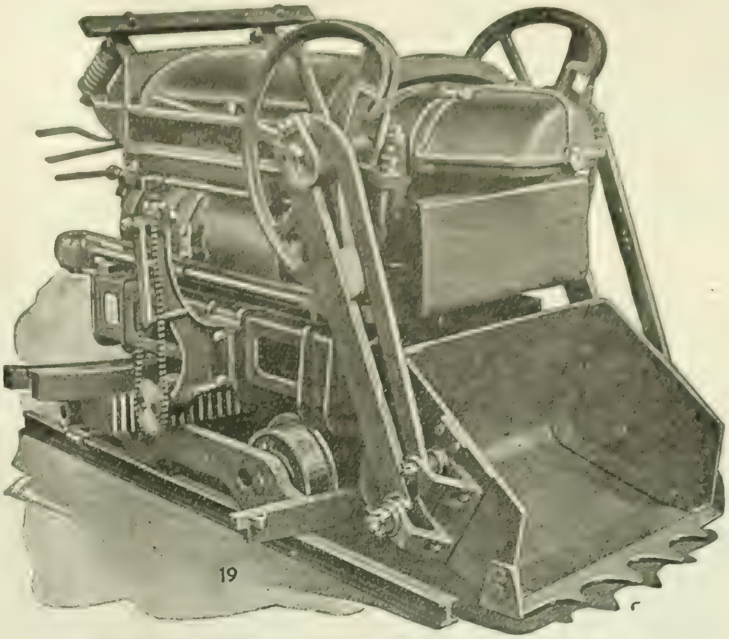
Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

THE SHUVELODER

The accompanying engravings illustrate the description of the Shuveloder published in PUBLIC WORKS, on August 7, Page 141.

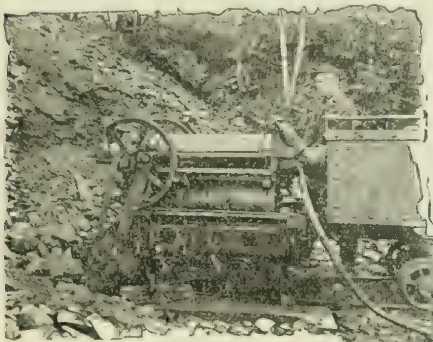
This machine, manufactured by the Lake Superior Loader Co., especially for loading muck and spoil in tunnels and in narrow trenches, can be operated in a transverse clearance of 5 feet and a vertical clearance of 7 feet; it commands a transverse width of 11 feet and can load at a heighth of 50 inches above top of rail. The bucket which, in the large engraving, is shown in the lowest position, previous to commencing the cycle of operations, is actuated directly by four pneumatic cylinders operating with a pair of slotted links and a rope-driven revolving mechanism that impart to the bucket a thrusting, lifting, and revolving motion with a reciprocating action and return movement closely simulating the operations of hand shoveling.

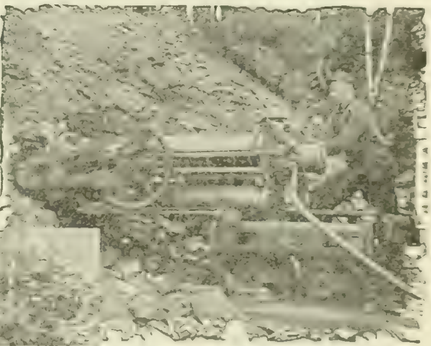
The operating views show the machine in position in a tunnel drift at each point in its cycle of operations.

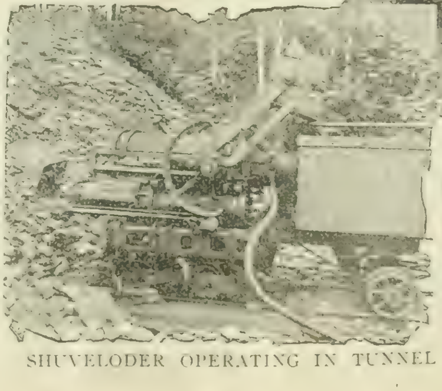


SHUVELODER MOUNTED ON PORTABLE TRACK

Special provision is made to avoid heavy stresses or injury to the machine when the bucket encounters unusually great resistance. The machine has a rated capacity of 45 tons per hour when operated by air under 80 pounds pressure, and requires only one man to handle it except when it is moved by hand on the narrow-gauge track, an operation which is easily effected, corresponding to the movement of a 2-ton dump car, and avoiding the expense and complication of locomotive gear.







SHUVELODER OPERATING IN TUNNEL

BARRETT PAVING PITCH

A small pamphlet just issued by the Barrett Company describes the use and advantages of cold tar pitch for water-pitch joints and fillers in brick, stone block, and wood block pavements. No. 1 is unaffected by water, alkalis, street acids, oil and gasoline, or any other matters commonly found in streets and roads.

It is strongly adhesive and cohesive and has sufficient elasticity and plasticity to provide for expansion and contraction. Its use insulates paving blocks and greatly decreases the noise of traffic.

Tarvia Mastic Filler, is a special grade of paving pitch for use with hot sand for wide joints in brick and wood pavements and for narrow joints in stone pavements.

The method of application is described and is illustrated by halftones of the work in progress and the equipment required for various kinds of pavement, and users are cautioned not to overheat the pitch, not to use coarse, cold, or damp sand with it, and not to let water get into the tar kettle.

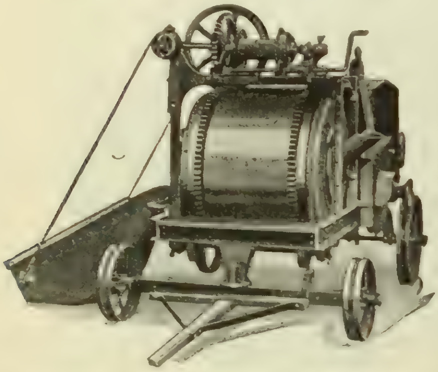
AMERICAN LA-FRANCE FIRE ENGINE CO.

The American La-France Fire Engine Co. Inc., announce the shipment during July of 39 pumping engines and cars to Japan and to points in 17 different states. They also announce the sale during the same of 20 similar pieces of equipment to different cities in the United States, ten of these sales being repeat orders.

KOEHRING CONSTRUCTION MIXER

Under this title the Koehring Machine Company has issued catalog No. 22, containing nearly one hundred pages illustrating and describing concrete mixers and other equipment for building construction purposes.

Special attention is given to a detailed explanation of the three distinct actions involved in the concrete mixing and the operation of the discharge mechanism that effect a remixing process to which the high strength of test cubes made from concrete mixed in these machines is attributed. It is also due to the measurement and control of the amount of mixing water by the automatic measuring tank and to the regulation of time by the batch meter.



DANDIE 104-S MIXER; 4 FT. CAPACITY; GASOLINE ENGINE

The principal features and details of the machine are clearly described with special reference to design and operation of the discharge chute, drum track and drive, framework and truck, charging skip, centralized control, and ample boiler and engine capacity for steam, gasoline or electric service.

Specifications and illustrations are given of mixers with rated capacities for 28, 21, 14, 10, and 7 cubic feet of wet mix. A convenient table is given showing the quantities of cement and aggregate required for one batch for each of the five sizes of machines and for either of nine ordinary proportions of concrete or for a 1:6 mixture of cement and gravel.

There are also very clear and specific instructions for the operation of the construction mixers and for the adjustment and operation of the water measuring tanks.

Besides the construction mixers above noted, the catalog gives complete data of the Dandie mixer, a portable machine of light weight and reliable construction made in two sizes with capacities of 4 or 7 seven cubic feet of mixed concrete per batch and capable of accomodating 6 and 10 feet respectively of unmixed material, and of discharging heavy concrete in 10 to 12 seconds and sloppy concrete in 15 to 17 seconds.

These machines are convenient for small work and for special service on large mixers. They are operated by Fuller & Johnson gasoline engines, have dust proof bearings wherever possible, and are designed with a low charging arrangement permitting the machine to be supplied direct from wheelbarrows when necessary, although pivoted charging skips are supplied. An auxiliary friction hoisting drum is also supplied if ordered for light service such as elevating concrete, timber, or mortar in buildings.

The catalog contains convenient tables showing the quantity of concrete for 1-inch slabs with dimensions up to 12½ x 22 feet; quantity of concrete in beams, girders and columns from 8 to 36 inches square and from 4 to 36 feet long; the quantity of concrete in footings from 1½ to 12 feet square and 28 inches to 30 inches deep; the amount of screened 1-inch stone and of screened and unscreened 2½-inch stone and of ¾-inch gravel required for 1 yard of rammed concrete in any one of more than 40 varying propositions.

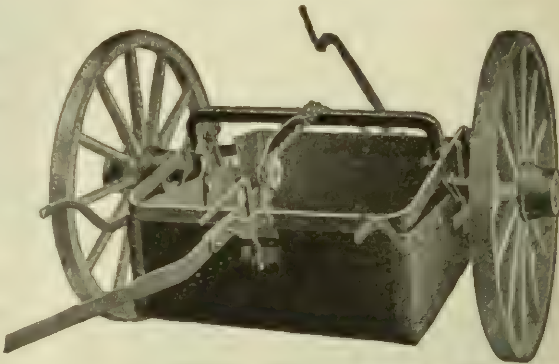
YOURS, FOR GOOD ROADS

An illustrated 40-page pamphlet entitled "Yours For Good Roads" and issued by the Smith & Sons Mfg. Co. in the interest of Royal road machinery, illustrates and describes wheel scrapers with special fore-truck and panhook attachment and adjustable skein. It also illustrates various types of buck, tongue and drag scrapers, the Monarch road drag with detachable blades, railroad and township versible road graders, new highway traction graders, Royal rock crushers, and Royal reversible road rollers.

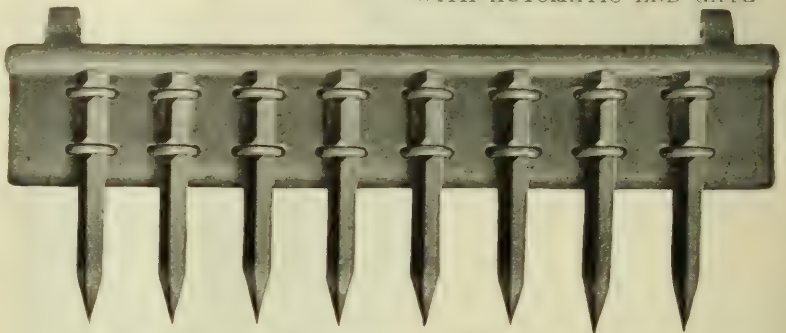
The Royal standard reversible road grader has an extra long draw beam that keeps the blade in the ground better and makes the grader run steadier. The 7-foot adjustable blades are capable of being extended to a length of 9½ feet for embankment work, thus requiring less power and giving greater economy in operation.

The circle for the revolving blade is made of high carbon steel with teeth specially cut to fit the reverse worm gear by which it is easily and quickly operated.

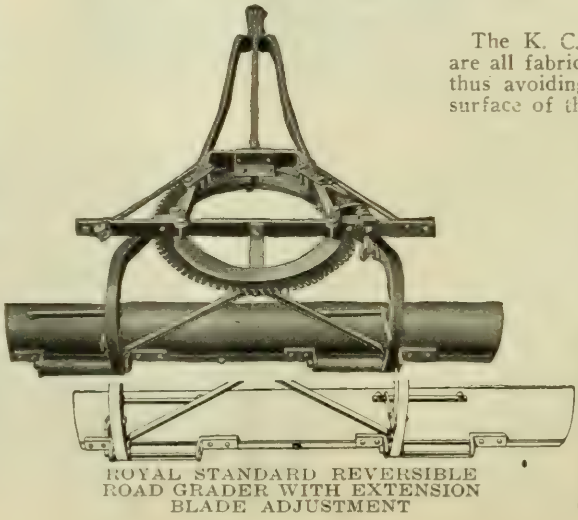
The Royal standard scarifier is an attachment interchangeable on the Royal standard or Royal special engine grader and has eight teeth made of tool steel strongly anchored by two U-bolts to the heavy cast iron beam. It weighs 600 pounds, and has teeth 1¾ inches square and 18 inches long.



HIGH BALL WHEEL SCRAPER WITH AUTOMATIC END GATE



ROYAL STANDARD SCARIFIER WITH DETACHABLE 1¾ x 1¾-IN. TEETH



ROYAL STANDARD REVERSIBLE ROAD GRADER WITH EXTENSION BLADE ADJUSTMENT

The K. C. Highball wheel scrapers are all fabricated without hot bending, thus avoiding injury to the hardened surface of the special steel. They are provided with automatically working end gates and have a new draft hook lug on the pan made in the form of a continuous loop that avoids difficulty from the opening of a hook lug.

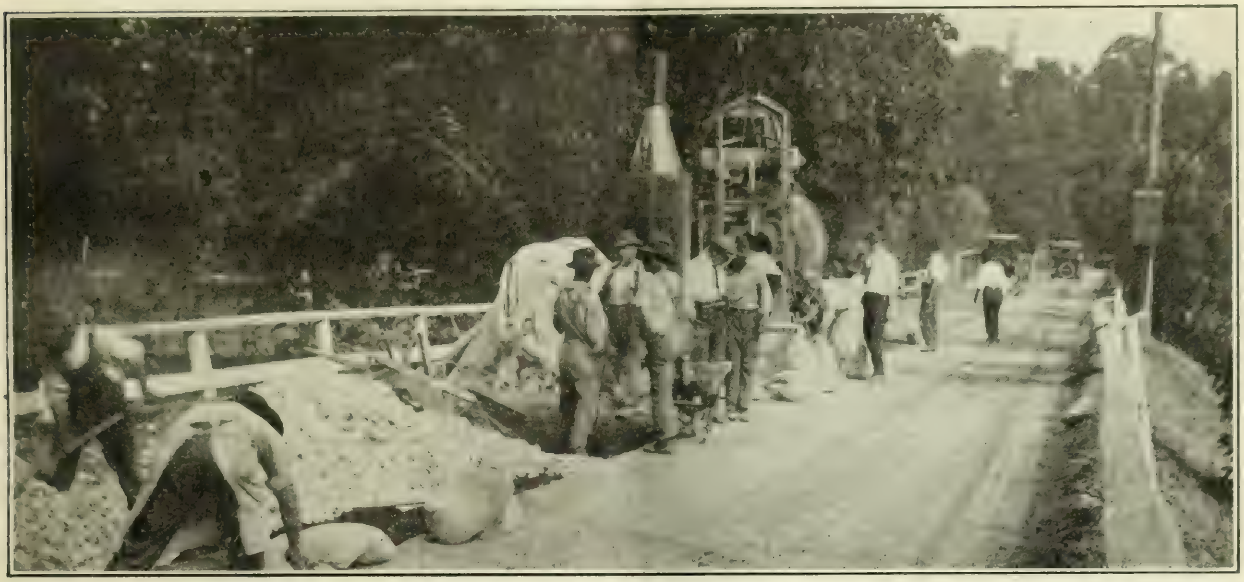
JACOB LOWENSTEIN

Jacob Lowenstein has opened an office in the Equitable Trust Building, New York City, as consulting engineer and for technical knowledge service and for services in purchase of steel for buildings, bridges and other structures.

PUBLIC WORKS.
CITY COUNTY STATE
A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"
Vol. 49 FLORAL PARK, AUGUST 21, 1920 No. 8

Building a Concrete Roadway in Halves

Heavy travel has been maintained continuously on a New York State Highway while a concrete pavement has been constructed which occupies the complete width of the embankment.



CONSTRUCTING THE SECOND HALF OF A CONCRETE PAVEMENT.

Note that the Pavement Extends to Within a Few Inches of the Fence and Traffic is Using the Finished Half of the Road.

To build a 20-foot concrete roadway on an embankment 22 feet wide and meantime keep the road open for a traffic of 4,500 or 5,000 automobiles a day, a considerable part of which pass during the night, was the problem which confronted the State Highway officials of District No. 1, New York State, and the contractor to whom the work was let, Louis Petrillo.

The work referred to was a section about a quarter of a mile long which formed a part of a contract of considerably greater length, being a point where the Post Road between New York and Albany crosses a low, swampy place on an embankment about 10 feet high in the town of Harmon. This road gets practically all of the traffic between New York and all Hudson river points, and much of that from New York to the Berkshires and other New England points. A part of this traffic consists of motor trucks of all weights up to the heaviest permitted by the state law, which is 25,000 pounds, and undoubtedly some infringements of the law exceeding this limit.

No detour which would be practicable for the heavy trucks was available except one which would add about 12 miles to the distance, and it was therefore decided to endeavor to maintain traffic over the road in question during construction, and this was made a provision of the contract. This necessitated the building of the road in two longitudinal halves, traffic being carried on one half while the other was under construction.

The road was designed as a concrete pavement 20 feet wide, 8 inches thick in the center and 7 inches at the sides. This was one of last year's contracts and did not call for reinforcement, as do all of the contracts being let in 1920. The road was an old macadam one and, with the shoulders, gave sufficient width, when one half was torn up for the construction of the concrete pavement, to permit traffic to pass on the other half if care was used.

The exception to this was the embankment referred to, which was only 22 or 23 feet wide on top between the fences which lined the two sides. When one half had been torn up for laying the first strip of concrete, it was, of course, impracticable for two lines of traffic to pass on the other half, and the same was true after the first half of the concrete had been laid and during construction on the other half. It has therefore been necessary for the traffic to be strictly regulated, traffic in one direction across the embankment being held up while that in the other passed, then the second line was held up while those in the opposite direction passed through. It was found necessary to keep members of the State Police constantly on hand to regulate this traffic.

This regulation of the traffic by no means eliminated the contractor's difficulties. With only about a foot of road between the finished pavement and the fence, there was no room for the use of wheelbarrows and barely sufficient for the finishers to use float, belt, etc. As there was no room along the side of the road for piling the aggregate, the stone and sand were placed in alternate piles on the subgrade and these occupied the entire width of the half-road under construction. This left no room for a wheelbarrow run over the subgrade.

CONSTRUCTION OCCUPIES ENTIRE WIDTH OF EMBANKMENT

The piles of stone and sand were alternated, so that it was necessary that one of these be carried from the pile to the mixer by a wheelbarrow or other method. The strip being something less than a quarter of a mile long, the contractor did not think it worth while to install any special contrivances for meeting this difficulty, but is relying entirely upon wheelbarrow and shovel for handling the aggregate.

The first half strip was finished early last winter, and the other side is now under construction. The contractor began work on the second half of the embankment on Monday, July 19th (on which date the work was visited by the writer) and over 200 feet was completed that day and it was anticipated that between 200 and 250 feet a day could be maintained as the rate of construction.

The broken stone had all been deposited in piles along the subgrade before the contractor began on this strip. The sand is obtained from a bank only a short distance from the work, and only a few piles are maintained ahead of the mixer. The piles are spaced a distance apart equal to the length of pavement that can be laid from one position of the mixer. When the concrete has been laid as close as possible to the mixer, this is moved until the skip is close to the next pile of aggregate. The sand or stone, as the case may be, (whichever material is nearest the mixer) is shoveled into the skip, and the other aggregate is brought to the mixer in wheelbarrows which have to pass over only the few feet separating the piles of aggregate, the traffic being held up for the 15 to 30 seconds necessary for this. Except for this, the traffic is not held up and is practically continuous throughout the day.

The concrete is mixed with a Foote batch mixer, which discharges it on the subgrade by means of a sectional chute. Seven men are used getting the sand and stone into the skip and adding the cement. An engineer runs the mixer, and four men on the wet end of the mixer distribute the concrete and finish the surface. For the latter purpose they use first a wooden screed, which is followed by a roller, this by a thin board, and the final surface is given by use of a belt. In the use of these finishing appliances it is, of course, necessary for one man to stand on the completed pavement, but by keeping close to the edge of this there is room between him and the fence for traffic to pass. Not all drivers are as careful as they should be, and there is some danger attached to this work and occasionally one of the men is struck by the wheel guards, although so far no serious injuries have occurred. In addition to the seven men on the dry end and four men on the wet end of the mixer and the engineer, there is one man dressing the grade after the aggregate has been removed from it and before the concrete is placed. These thirteen men, with the foreman and water boy, constitute the gang.

The same plan of constructing the pavement in 10-foot strips has been adopted for all of this contract. The difficulties for contractor and highway department, as well as the inconvenience to traffic, are not so great over the wider parts of the road; but, even taking the contract as a whole, the engineers of the highway department find so many objectionable features connected with the plan that they probably will not adopt it for any future construction if it is possible to locate detours.

The work is being done under the supervision of J. B. Egbert, county assistant engineer. The division engineer for this division of the state highway system is James H. Sturdevant, with headquarters at Poughkeepsie.

Limiting Truck Loads

The City of St. Louis has passed an ordinance prohibiting the excessive loading of trucks and providing fines of from $5 to $500 for violations of the ordinance. A maximum total load of 28,000 pounds, a maximum axle load of 22,400 pounds, and a maximum load of 800 pounds per inch width of tire are prescribed. Permits may, however, be secured under certain conditions for the transportation of loads in excess of these amounts to be hauled over certain specified routes.

Traffic on Pennsylvania Highways

A traffic census was taken on sections of the Lincoln Highway and the William Penn Highway in Pennsylvania on July 25th and 26th, traffic being counted at ten points on the former and at three points on the latter

The heaviest traffic was found in Chester county on the Lincoln Highway, where 3,877 passenger cars and 82 trucks were counted on Sunday, July 25th, and 2,301 passenger cars and 1,013 trucks on the following day. There were also 125 motorcycles and 33 teams on Sunday and 43 motorcycles and 74 teams on Monday.

On the William Penn Highway the heaviest traffic was found on the section between Bethlehem and Easton. On Sunday, July 25th, 3,243 passenger cars and 75 trucks were counted, and on the following day 1,002 passenger cars and 270 trucks. In addition there were 159 motorcycles and 8 teams on Sunday and 60 motorcycles and 25 teams on Monday.

One section of the William Penn Highway had been oiled several days prior to July 25th and the traffic therefore was not so heavy as ordinarily on this section.

The heaviest team traffic counted was between Philadelphia and Morrisville, where 117 teams were counted on Monday and 54 on Sunday. This strip also gave the highest count of motorcycles, there being 343 during the two days. Here also was by far the heaviest truck traffic, 265 being counted on Sunday and 546 on Monday. The passenger cars on this strip were 2,467 on Sunday and 922 on Monday.

Of the several sections on which census counts were made, that showing the least travel was the Lincoln Highway between the town of Bedford and the Fulton county line. On Sunday the count here was 690 passenger cars, 51 trucks, 28 motor cycles and 17 teams; and on Monday there were 285 passenger cars, 101 trucks, 11 motor cycles and 47 teams. This gave a total of 1,230 for the two days, as compared with 7,554 on the same highway between Coatesville and Downington.

The total of all kinds of vehicles counted on both days at ten points on the Lincoln Highway was 32,531, or an average of 3,252 at each point. On three sections of the William Penn Highway the total counted was 8,077, or an average of 2,692 at each point. The count at all thirteen points on the two days showed a total of 34,165 passenger cars, 3,780 trucks, 1,863 motorcycles and 800 teams.

Army Convoy Over Bankhead Highway

A convoy of sixty-five motor vehicles left Washington on June 14th over the Bankhead Highway and expects to reach Los Angeles on September 17. The object is to demonstrate the practicability of the motor truck for transcontinental service, to obtain data on highway and bridge construction and topography for military purposes, to call attention to the need of transcontinental highways, and to stimulate army recruiting.

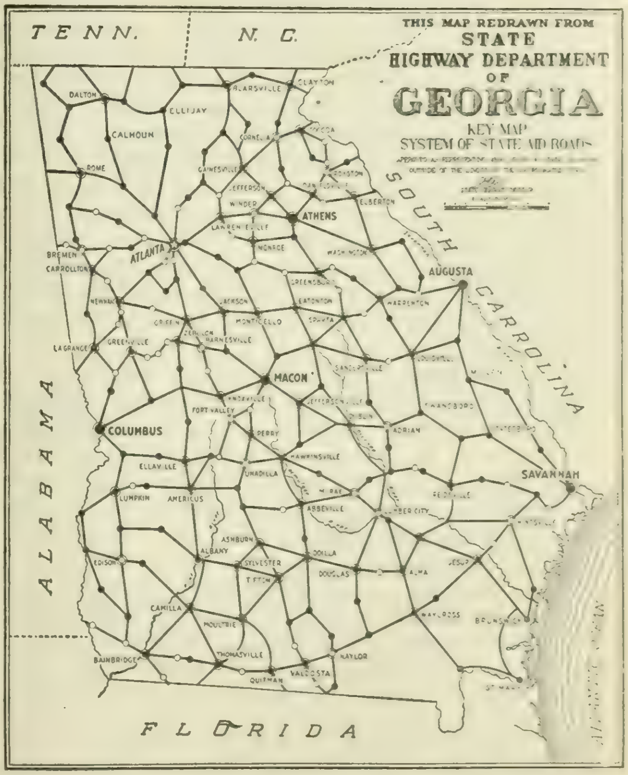
The train comprises a motor transport company containing a Dodge touring car, Dodge delivery truck, five White 1½-ton cargo, eight Garford 1½-ton cargo, eight Packard 1½-ton cargo, four Standardized B" cargo, two F W D cargo, one kitchen trailer and two motorcycles. There is also a service park unit consisting of a Dodge touring car, two White 1½-ton machine-shop trucks, one Dodge light delivery truck, two White 1½-ton cargo trucks and one Cleveland tractor. The headquarters command will occupy two Cadillac touring cars, three Dodge touring cars, two White staff observation cars, one G M C ambulance and four motorcycles.

The Government hopes to duplicate along this highway the educational and other advantages secured by a similar convoy sent last summer over the Lincoln Highway.

Georgia's Highway System

The state legislature of Georgia last year passed a bill providing for the reorganization of the state highway department and directing the state highway engineer to select and prepare a map of a system of state roads that would connect each county seat of the state to the neighboring county seats, at least two such roads reaching each county seat, and also provide for interstate connection; the total milage was to be limited to 4,800 miles. Such a map has been prepared by the state engineer, W. R. Neel, and is shown in the accompanying illustration.

In order to provide the cost of constructing



PROPOSED GEORGIA ROAD SYSTEM

this system, the license fees for motor vehicles were increased and the funds are to be used exclusively for the construction and maintenance of the state system, to which will be added the federal aid funds. The law provides that at least 70 per cent of the funds so obtained shall be expended in actual paving work. The state has been divided into twelve districts with a division engineer in charge of each, each of these engineers being a carefully selected man with highway engineering experience. The organization is now practically completed and is working smoothly.

Advisory Transportation Engineering Committee of Interstate Tunnel Commission

Discussion of width of roadway, kinds of vehicles that will use tunnel, kinds of materials that will be hauled, legislation and other problems.

A meeting of the above committee was held on July 8th at the Automobile Club of America, 247 West 54th Street, which was presided over by H. J. Moran, Engineering Department, of the International Motor Company. The object of this committee is to offer constructive criticism and to make recommendations to the chief engineer as to what the proper width of roadway should be to safely operate the maximum amount of motor vehicle traffic through this proposed tunnel between New York and New Jersey. This committee is composed of representative engineers having actual road transportation experience. There are six members representing the motor truck interests and also a member from the allied trucking interests—H. J. Moran, chairman, representing the International Motor Company.

A short talk was delivered on the tunnel proposition by Mr. Clifford M. Holland, chief engineer of the Tunnel Commission; there was considerable discussion as to what the minimum width of roadway should be for the safe operation of two lines of vehicles going in the same direction. Finally, a motion was made and carried, the question held over until the next meeting.

It was the consensus of opinion that semi-trailers, commonly called "tractor-trailers," would come into general use in the next few years, especially so inasmuch as the connecting link between the two states would tend to develop this end of the motor vehicle industry.

The following vehicular tunnel data were announced for discussion by the Advisory Transportation Engineering Committee:

1. What should minimum width of roadway be?
2. Is it necessary to make practical road test with several motor trucks loaded, at various speeds as 3, 5, 7, 10, 12, 15-miles per hour, running trucks in two lines three or four deep and properly spaced with roadway each side of truck covered with whiting or some other substance that will show wheel tracks? Probably a 500 ft. wooden model should be built to determine this.
3. Traffic that would predominate in use of tunnel—motor trucks. The hundreds of freight cars of materials that are lightered into New York City daily will be transported through this tunnel via truck.
4. Limitations of tunnel engineers—economic standpoint, first cost, carrying charges, maintenance. (Width of tunnel governs this).
5. Character of truck payloads of today and loads of the future.
6. Truck limitations of today (by law) and laws of the future.
7. The known fact that 90 per cent of trucks in service today are under-powered, overloaded, and wheels out of alignment.
8. Minimum width of road for vehicle of today (8 feet now allowed). Careful consideration of future legislation in favor of wider vehicles possibly 9 feet or 8 feet 6 inches over hubs.
9. Possible movement from time to time of War Dept. motor vehicle equipment, as portable kitchens, welding shops, machine, blacksmith, printing, portable camp lighting and searchlight equipment.
10. Possible legislation favorable to tractors which may five years from now be permitted to transport 15 to 20-ton loads.
11. Possible necessity of transporting via motor truck from within radius of 250-miles of New York merchandise, machinery, food and general materials urgently required for loading at seaboard.
12. Possibility of bringing into N. Y. fabricacted steel, concrete aggregate, cement, etc., for buildings as well as the influx that will result from new industries that will be built up on the Jersey meadows.
13. Possible elimination of street car lines and future motor bus lines running from possibly 14th Street to Jersey and Hoboken through tunnel.
14. Disabled and broken down trucks, possibility of broken axle, bearing, wheel, collision, etc., to cause all traffic to be blocked. Possibly dollies and heavy jacks should be stored at frequent intervals.
15. An electric signalling system with traffic officers to be located.
16. Space allowance possibly under recess in walls to store emergency apparatus which will enable mechanics to get disabled vehicle to one side.
17. Roadway not to have crown.
18. Possibility of legislation favorable to trailers for which pneumatic brakes, etc., may be adopted.
19. Collection of Tolls.

Report on Milwaukee's Water Supply

Experiments extending over twelve months were conducted to try out certain features of rapid sand filtration of the lake water and determine which would give best results with greatest economy. The water was clear but fairly high in bacteria and especially in certain algae.

A few weeks ago Jos. W. Ellms submitted a report to the commissioner of public works of Milwaukee, Wis., giving a description of and his conclusions from a series of experiments on the purification of that city's water supply. On March 25, 1918, the common council of Milwaukee directed the commissioner of public works to "carry on experiments in water filtration and other methods of purifying the city's water supply, and to purchase the necessary tanks, apparatus, machinery, chemicals and other supplies, materials and equipment which he deems necessary therefor;" provision being made for the employment of a consulting engineer to construct the experimental plant and supervise the investigation. The commissioner employed Mr. Ellms for this work.

A plant was constructed, including the building for housing it, and regular operation of the plant for experimental purposes was begun on February 1, 1919. In his report Mr. Ellms divides the operation of the plant into forty-seven periods of various lengths in order to try out different details of plant and of operation. Over 100 different combinations of mixing devices, settling tank and filters, operating at varying rates of flow, were outlined, but only those lines of investigation were selected which would most quickly establish the more important facts to be determined. The experiments were continued until January 24, 1920.

The general line of investigation followed is summarized by Mr. Ellms as follows:

1. To study the physical, chemical and bacteriological characteristics of the water supply of Milwaukee as obtained from Lake Michigan.

2. To observe the general effect of seasonal and other changes in the character of the raw lake water, and their relation to the purification processes studied.

3. To study the efficiency of rapid sand filtration as a method of purification:

a. To investigate methods of mixing chemicals with the water to be treated in order to produce maximum coagulative effects in the minimum space of time.

b. To ascertain the shortest effective periods of sedimentation.

c. To determine the highest rates of filtration consistent with a proper degree of clarification and bacterial removal.

d. To study the effect of a modification of a common type of filter strainer system on the filtering and washing processes.

4. To study the efficiency and applicability of ozone as a disinfecting agent for both raw and filtered water.

5. To make any necessary studies on disinfection with chlorine for determining its efficiency under local conditions and for comparison with disinfection by ozone.

The subject matter of the experimental work described in the report was for convenience divided into five main sections:

1. Quality of Lake Michigan water.
2. Filtration as a method of purifying the water supply.
3. Quality of the filtered water.
4. Disinfection as a method of purification.
5. Conclusions and recommendations.

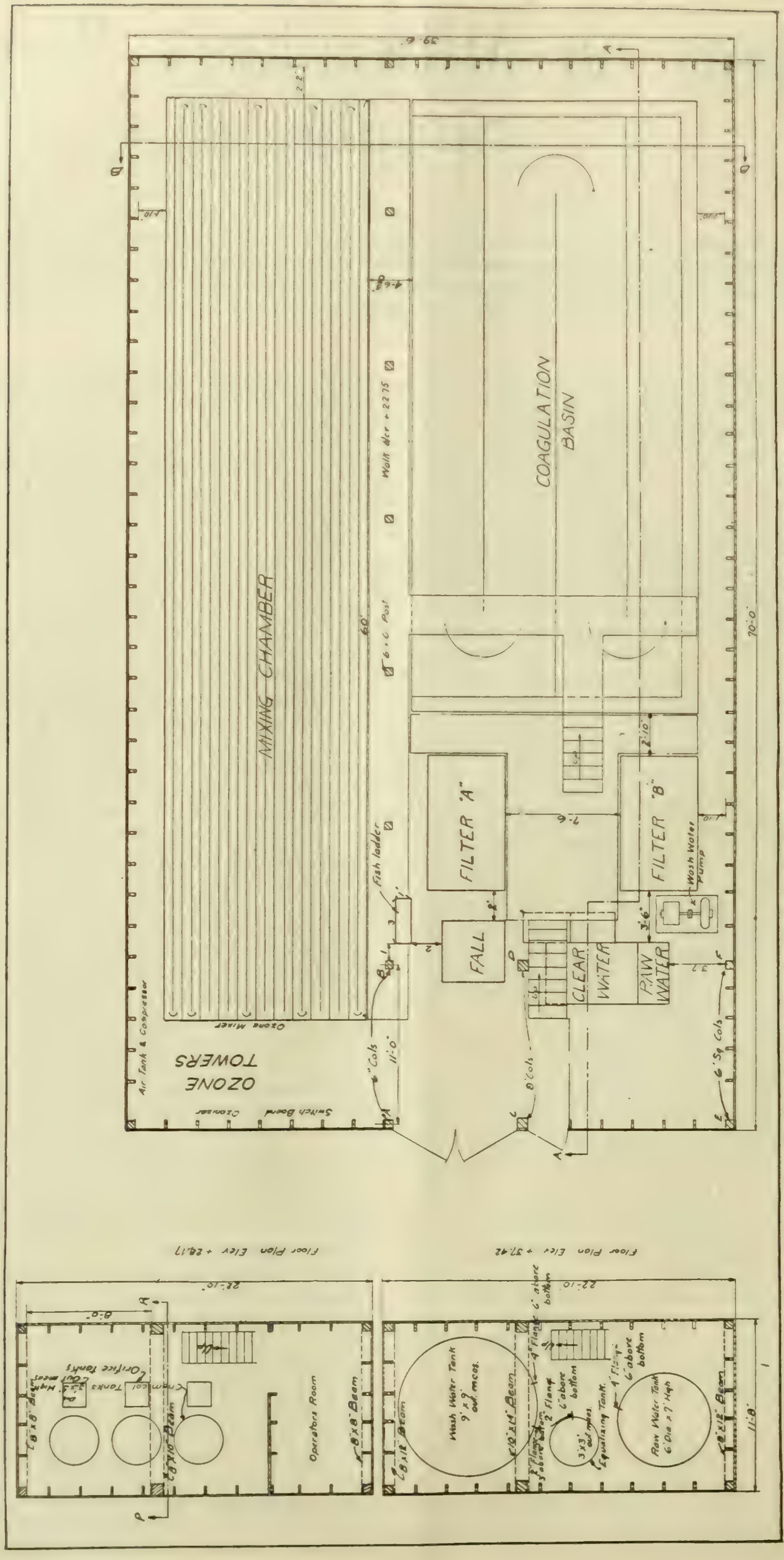
As a part of the report there were submitted five appendices covering the following subjects:

1. Description of experimental filtration plant.
2. Description of experimental ozone disinfection plant.
3. A detailed record of the filter plant operation periods.
4. Special laboratory investigations
5. Tables of averaged data.

Experiments were made on rapid sand filtration, using both alum and also iron and lime as coagulants; and ozone as a sterilizing agent.

The plant was housed in a frame building 70 feet x 39.5 feet and 12 feet high, with a tower 40 feet high in one corner. The tower contained raw and filtered-water head tanks, a wash-water tank, and three chemical solution tanks with their orifice boxes. The main part of the building contained various mixing devices, a settling tank, two filters, and the ozone apparatus. The filtration plant had a capacity of about 300,000 gallons per day, and the ozone disinfecting plant a capacity of about 8,000 to 9,000 gallons per day.

For mixing the coagulating solutions and the raw water, four different types of apparatus were used —mixing channels, a fish ladder, a "fall," and a "flume." The first consisted of a tank provided with baffles of "around the end" type, which was 60 feet x 11 ft. 9 in., and occupied nearly the whole of one side of the building. This contained twenty-two channels each 60 feet long and about 13 inches deep and 5½ inches wide. The fish ladder consisted of a tank 7 feet high and one foot by 3 feet in plan, which contained seventeen baffles placed 4 inches apart, the passing space between ends of baffle and side of tank being 4 inches by 1 foot.



GENERAL PLAN OF MILWAUKEE EXPERIMENTAL FILTRATION PLANT

The "fall" consisted merely of a wooden box 4 feet x 4 feet in plan and 3 feet deep. Near the top and extending the whole width of one side was a receiving tray approximately 10 inches by 10 inches in cross section. The water and the coagulant solution spilled over the side of this tray onto an apron set at an angle of about 45 degrees which had two riffle strips 1 inch high extending across the entire width of the apron. The water fell from the apron onto a pile of stones with the idea of still further agitating the flow. The "flume" consisted of a trough or flume 28 feet long, 2 feet wide and 1 foot deep containing thirteen riffles 6 inches high and set 2 feet apart throughout the length of the flume. The flume was set at a slope such that the water had a total drop of about 4 feet.

Mr. Ellms placed considerable emphasis upon the importance of thoroughly mixing the coagulant with the water, and for this reason tried out the devices described above, which were all believed to be more or less novel and departures from existing practice. They are simpler and very much less expensive to construct than the mixing chamber ordinarily used for this purpose.

CHARACTERISTICS OF THE LAKE WATER

The water of Lake Michigan used by the city is unusually clear and cold, the average temperature being approximately 43 degrees and reaching a maximum of 74 degrees in summer. Considerable variations in temperature are noticed at short intervals of a few hours or even minutes

The average turbidity of the water was between six and seven parts per million, a maximum of 160 parts having occurred in March. The higher turbidities naturally occur after long-continued storms which set up currents that scour the bottom in the shallow portions of the lake. For long periods the water is exceptionally clear, although there is always a very slight turbidity due to small amounts of very fine silt. An examination of the silt settling out from the lake water showed 46.2 per cent passing a 200-mesh sieve and only 5.9 per cent additional passing a 100-mesh sieve. The balance or 47.9 per cent retained on the latter sieve consisted of ordinary lake sand. A considerable part of the turbidity is not included in this, being so fine that it was not deposited at all.

The mineral constituents of the water are more typical of a ground water than of a surface water. The organic constitutents were quite low and uniform in amount. On the whole, there is little information to be gained from the chemical analyses with reference to pollution of the water by sewage.

The average results of the analyses gave the following figures in parts per million: Total solids, 160; total hardness, 116; temporary hardness, 110; permanent hardness, 6; chlorides, 4; sulphates, 13.1; calcium, 35.3; magnesium, 11.7; free ammonia, .021; albuminoid ammonia, .078; nitrites, .003; nitrates, .05; oxygen consumed, 2.1.

The bacteria in the lake water were considered to furnish a better clue to the amount of pollution than did the chemical constituents. The number of bacteria grown on agar in 48 hours at 20 degrees C averaged less than 1,000 per c.c., but ranged from 7 to 48,000. The average B. coli index figure for the year was practically 10.00 per c.c. and the monthly averages varied from 1.62 to 19.61. These figures were considered to indicate unquestionably that the water entering the intake is at times badly polluted with sewage.

Practically all of the sewage of the city now discharges into the harbor, and the "North Point" intake is about 3.5 miles north of the harbor, while the Linwood Avenue intake is 1.5 miles further north. Studies were made of the effect of the winds in producing currents in the lake and the effect of such currents in carrying pollution from the harbor to the intakes. Studies were made with floats and otherwise and it was found that any air movements or variations in barometric pressures which tend to affect the lake level, or any flood conditions in the rivers which increase their hydraulic gradients cause more polluted water to be carried into the lake by these streams, and for the time being increase and widen the zone of pollution of the lake water. If, coincident with or following immediately after this, winds of proper velocity and duration cause the polluted water to be carried toward the intake, there exist all the conditions for a serious contamination of the water supply.

The report goes into this matter at considerable length and the conclusion is drawn that it is unmistakable that "if the water is not at all times dangerously polluted, it is so frequently contaminated that it is for all practical purposes a constant menace to the health of the city."

One of the features that received considerable study by Mr. Ellms was the existence in the water of a microscopic organism which seriously added to the difficulty of filtering the water by reducing the time for which the filters could be operated without washing. As warm weather approached, fishy odors were noted occasionally in the filter building, the cause for which was found to be the presence of microscopic plants. The diatoms were especially prominent, the Synedra being most numerous, but there also being considerable numbers of Asterionella, Diatoma and Tabellaria.

The conclusions from all of the investigations as to the quality of the lake water are summarized by Mr. Ellms as follows:

1. The water is for the most part fairly clear and cool. It may be, however, quite turbid at times, and cannot be called a clean water when judged by modern standards.

2. The water is moderately hard, but its hardness is practically all the so-called "temporary hardness," its "permanent hardness" being very low.

3. The water contains very little organic matter, but is infested with micro-organisms which, if of the right species and in sufficient number, may cause objectionable tastes and odors. These tastes and odors should not be confused with those due to industrial wastes in combination with chlorine used to disinfect the water supply.*

4. The water is polluted with sewage. This contamination of the intake water is intermittent, but nevertheless frequent. Judged by a tentative standard adopted by the International Joint Commission on the Pollution of Boundary

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*Such a combination had caused very bad tastes in Milwaukee city water in 1918.

Waters between the United States and Canada, and having special reference to the permissible degree of pollution of the Detroit and Niagara rivers, the water now entering the waterworks intake is on an average twice as impure as it should be.

GENERAL CONCLUSIONS

The general conclusions from the entire investigation were that Lake Michigan offered the natural and only practicable source of water supply for Milwaukee; that it possessed several desirable physical and chemical properties, such as low temperature, comparative freedom from suspended matter and relatively little hardness. However, it is badly polluted by the sewage of the city and, from a sanitary standpoint, cannot be used unpurified without danger.

The city is making arrangements to purify its sewage, and this will probably ameliorate these conditions to some extent, but there is still remaining the pollution produced by the three rivers emptying into the bay, which rivers will receive overflow from the sewers during storms and the surface washing from communities along their banks.

Mr. Ellms quotes from the report of the advisory engineers to the International Joint Commission on the Pollution of Boundary Waters between the United States and Canada, as follows:

"While present information does not permit a definite limit of safe loading of a water purification plant to be established, it is our judgment that this limit is exceeded if the annual average number of B. coli in the water delivered to the plant is higher than about 500 per hundred c.c., or if in 0.1 c.c. samples of water B. coli is found 50 per cent of the time. With such limit the number of B. coil would be less than the figure given during a part of the year and would be exceeded during some periods."

The water entering the Linwood Avenue intake averaged 998 B. coli per hundred c.c., or practically twice the safe loading that a filter plant should be obliged to handle, and it would therefore appear that, even with the anticipated reduction in the pollution of the lake water, there are urgent reasons for undertaking its purification to safeguard the health of the city's water supply.

The experiments demonstrated that a filtration plant would remove all of the suspended clay and organic matter and 90 per cent of the bacteria, leaving on the average about 37 per cent of total bacteria of 1.6 as the index figure of B. coli. The tests on coagulation and filtration will be described in a following issue.

It was unnecessary to demonstrate the efficiency of chlorine for disinfecting the filter effluent, since this has been proved by several years of service. Test was made of a method and apparatus installed by a Milwaukee company for disinfecting by ozone. That ozone has the desired effect did not need demonstration. but the tests "show the apparatus for making the ozone to be of rather low efficiency and to possess only one or two features of especial merit over other apparatus previously produced. The compression of the air prior to its passage through the ozonizer is a good feature, as it avoids many difficulties arising from handling a corrosive gas through pumps or injectors. The ozonized air being under pressure, its application is more easily regulated than in suction apparatus. The tower method of applying the ozonized air is simple and can be made effective." Apparently the operation of the plant can be further improved. Losses of ozone were high, which increased the cost of the treatment. During part of the test a mechanical mixer or emulsifier was tried out, but appeared to offer no marked advantage over the towers except where room for the latter would not be available, while the power required to operate it might add considerably to the cost.

It appeared that this apparatus was still in the experimental stage for municipal water works purposes, and the cost of both the construction of the plant and the operation would greatly exceed that of chlorine.

(To Be Continued)

Fat Profits in Los Angeles' Garbage

The Pacific Reduction Company has made total profits during the past five years, from handling city garbage, of $73,153.80, of which $26,633.45 was paid out in dividends, according to figures contained in financial statements filed with the city auditor by general manager H. J. Murphy.

On motion of councilman Wheeler, the council passed a resolution asking the company to present its books for examination to show the profits it has made out of the sale of grease, fertilizer and other products manufactured from the garbage.

Preliminary examinations of the figures by chief accountant Francis Marshall of the city auditor's office showed that the company had made profits of $17,481,36 in 1916; a loss of $9.020.42 in 1917; a profit of $17,337.72 in 1918; a profit of $28,656.22 in 1919, in addition to paying dividends each year averaging $5,500, these dividends being charged to operating expenses, according to Mr. Marshall.

According to the figures submitted, the garbage disposal plant was valued at $363,295.98 on Jan. 1, 1916; and is now valued at $274,558.99.

Protest Against Builders Using Streets

Building contractors who, for the purpose of more effectively carrying on their work, have occasion to barricade sections of street and sidewalk adjacent to the sites where they are operating, should pay rent to the civic authorities for such space on the basis of so much per square foot per given time, in the opinion of the Civic League of Improvement Clubs and Associations of San Francisco. The league holds that they ought to be licensed to erect such barricades.

The secretary of the league, in behalf of that body, urged this in a letter to Supervisor William Stoddard Scott, chairman of the special license committee of the Biard of Supervisors. The letter carries also a protest against unnecessary occupancy of streets and sidewalks by contractors.

Constructing Water Supply Works of Winnipeg*

By W. G. Chase

Manufacturing concrete pipe and laying and backfilling same in tunnel. Study of effect of alkali soil on concrete. Efficiency of the excavating plant.

PIPE MANUFACTURE

All this pipe was manufactured in a yard at Transcono, 1 mile north of the line of work, but convenient to railway tracks for the receipt of reinforcing steel and of cement. This yard was laid out as a double ended equipment and the longitudinal halves of the yard were duplicates in most particulars.

Eight Little Wonder concrete mixers served the yard and permitted the manufacture of an average of about thirty lengths of 66-inch pipe per day. The reinforcing mesh, delivered in 46-inch widths, and incidentally the heaviest mesh ever manufactured, was bent to shape in special rolls located on one side of the middle of each end of the yard. The square twisted steel bars used in manufacturing the interior cage or reinforcement were bent to shape and assembled in cages on the opposite point of the yards.

The pipes were cast within steel forms set up upon a double line of concrete bases reaching from end to end of the yard Provision was made for the admission of steam to and about these forms. After the pouring had been completed, steam was furnished from a boiler plant located in the middle of the yard.

The mixed concrete was transported from the mixers at the ends of the yard to the forms by means of a specially designed travelling derrick or crane whose outrigger arms supported conical concrete buckets which discharged through a plug valve in the bottom of the bucket on a circular disk set upon the inner form of the pipe. The pipe was cast spigot end upward, a special form being provided for the formation of the spigot and for the support of the copper water stop during the process of pouring.

MIXERS BEING INSTALLED AT TRANSCONA

Storage of the pipe after steam curing was provided along each side of the yard, the pipe being laid horizontally upon transverse runways. It was loaded for shipment upon cars spotted on tracks lining the outer edges of the storage yard.

RED RIVER TUNNEL CROSSING

The Red River is crossed with cast iron pipe 60 inches in diameter, set within vertical shafts lined with concrete, and within a concrete lined horizontal rock tunnel 10 feet square. Complete valve control is provided at each end.

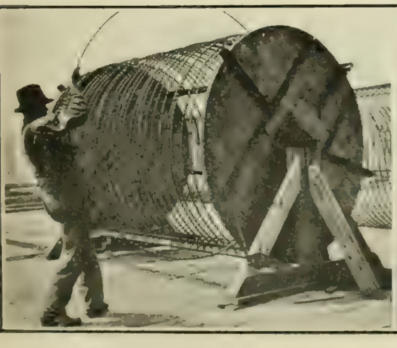
On the easterly end a reinforced concrete circular surge tank with concentric receiving tank was built, the whole being housed in for frost protection within a masonry shell. The construction of this work afforded very few difficulties.

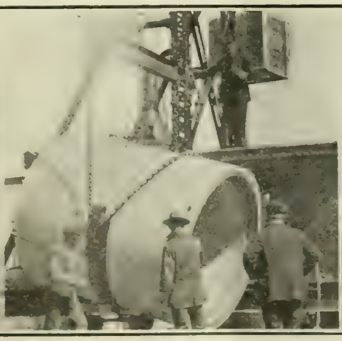
One notable feature, however, was the manner adopted by the contractors for the support of the walls of the excavation for the receipt of the surge tank. The floor was about 20 feet below the surface of the ground. This support consisted of a fifteen-sided timber mitred framing without shoring, dressed with vertical sheeting. This arrangement gave clear access to the whole of the interior and was a perfectly safe protection for the 50-foot diameter of excavation. The well structure is supported on concrete piers sunk to rock.

CONCRETE LINING AND BACK FILL

The shaft lining, of 2-foot reinforced concrete circular wall, was shod with heavy steel plate and was built in sections as the lining was sunk by excavation from within; it proved easy to maintain this 16-foot shaft in vertical position on center.

The cast iron pipe lining of the tunnel proper was designed in 8-foot lengths with special interior joints caulked with lead wool.


ASSEMBLING REINFORCEMENT BAR CAGE


LIFTING AND TURNING PIPE

LOWERING PIPE INTO TRENCH

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*Concluded from page 152.

POURING TWO PIPES SIMULTANEOUSLY

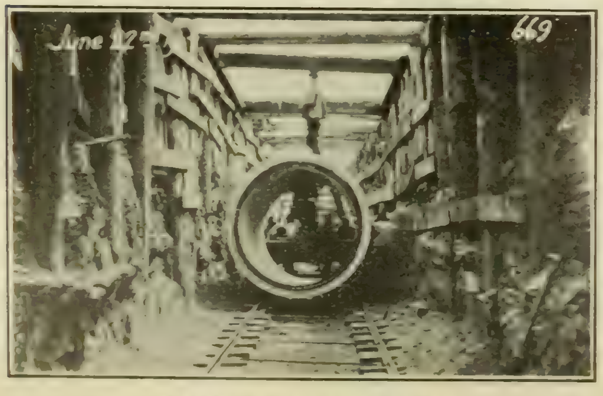
The backfilling of concrete around the pipe in the tunnel was done through tremies consisting of 4-inch well holes sunk from the surface of the ground or through the bed of the river as the case might be. At each stage 150-foot lengths of tunnel were refilled, concrete being built up to within about 1 foot of the roof of the tunnel excavation, and the remainder of the cavity being filled with mortar. The mortar was poured continuously down one tremie until it rose to at least river level in the other tremies entering the section. This insured the sealing of the tunnel solidly under heavy pressure.

CONCRETE IN "ALKALI" SOIL

This is a subject of vast importance to the municipalities and other owners of concrete structures throughout central Canada and central United States. The injurious elements found in the soils are the sulphates of metals as above listed and these sulphates in the presence of ground water attack the concrete from the outside, transforming it into a sulphate of calcium, destroying its cohesion and ultimately wrecking the structure.

Unfortunately this is proven from the experience of the cities of Winnipeg and St. Boniface with concrete sewers; of building owners with respect to foundations in Saskatoon, Moose Jaw, Winnipeg and other cities; and of course of irrigation projects who are losing their canal linings, their controlling works and their concrete siphons or pressure pipes.

The engineers of the Water District after 1916 took the precaution of providing underdrainage for the trench carrying the pressure pipes of the Red River Valley inverted siphon, as about that time it became evident that it is very doubtful whether Portland cement concrete of ordinary consistency, strength or density, porosity or permeability is safe against the attack of these ground water solutions of sulphate salts.



CARRYING PIPE INTO PLACE

A portion of the 100,000,000 gallon structure, that is between Miles 13 and 17, 96-inch diameter by 8-inch wall concrete pipe is now found to be suffering decay on its surface from these agencies and the Water District is engaged in a program of sub-soil drainage parallel to the conduit and reasonably close thereto, in the hope that this drainage by lowering the ground water plane between two such parallel drainage trenches will cause the action to cease.

Fortunately, the soils which contained these salts extend over a small area of the country crossed by this important water supply project and a system of ground water tests is being established so that the risk can be continually observed and necessary precaution can be taken from time to time.

EFFICIENCY OF EXCAVATION PLANT

The efficiency obtained with the machinery installed is indicated by a few records of earth excavation from the trench with the various classes of machinery engaged:

Type of machine	Capacity	Depth of cut	Material Excavated	Average Yardage Excavated 10-hour day
Marion Shovel	1½ cu. yd. dipper	12 ft.	Clay	612
Walking Dredge	1 cu. yd. dipper	8 ft.	Clay	745
Dragline Bucyrus	1 cu. yd. bucket	6 ft.	3 ft. peat, 3 ft. sandy clay	640
	1 cu. yd. bucket	7 ft. 5 in.	1 ft. top soil, 6 ft. 5 in. fine sand (wet)	740
	2 cu. yd. bucket	9 ft.	2 ft. peat, 3 ft. fine sand, 4 ft. sand and gravel	900
	2 cu. yd. bucket	14 ft.	12 ft. peat, 2 ft. clay in bottom of trench	1950
	3½ cu. yd. bucket	18 ft 5 in.	6 ft. peat, 125 ft. clay	2920

A summary of the approximate quantities involved in the construction of the scheme: Earth excavation and backfill, 7,500,000 yards; rock excavation, 16,000 yards; concrete, 455,000 yards; reinforcing steel, 10,000 tons; Portland cement, 575,000 barrels.

Stream Pollution By Canton Sewage

Residents along Nimishilen creek, south of Canton, Ohio, have protested to the State Board of Health against the alleged pollution of the stream by Canton and a petition with 3,000 signatures has been filed with the board requesting the abatement by the board of the nuisance caused by the pollution. It is said that sewage is dumped into the creek by the city in such quantities as to be an intolerable nuisance; that flour mills using the stream for power have been forced to suspend operations because of the odor from the water, and that owners of land abutting upon the creek find sewage solids deposited along the banks to a considerable depth and emitting offensive odors. It is claimed that manufacturing plants and the city are both responsible for this condition.

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Refusing Priority to Water Purification Chemicals

Reference was made in PUBLIC WORKS a few weeks ago to the fact that priority rulings on freight have interfered with the delivery to cities of chemicals needed for purifying their water supplies. An instance of this is found in Richmond, Va., which a few days ago was almost entirely without alum and chlorine. The chemicals had been ordered weeks before but the railroads had side-tracked them and they could not be located. Warning was sent out by the directors of public utilities and public welfare that unless these chemicals were received within three days the supply would be entirely exhausted and the citizens should boil all water before using it. Efforts were made by city offiicials and the state Department of Health to have the chemicals delivered, but without effect. The citizens were warned to keep careful watch of the water and at the slightest indication of turbidity to accept this as a warning that purification of the water had ceased and to consider it as dangerous and boil it and take other appropriate precautions.

It is no exaggeration and is a statement which can be supported by numerous instances, that the delivering of unpurified water in cities where purification plants are regularly in operation, even if the purification ceases for only a day or two, may cause hundreds of cases and scores of deaths from typhoid fever. Considering the many cities and the millions of consumers that are now being supplied with filtered and chlorinated water, it is appalling to think of the possible and even probable consequences of any considerable percentage of these finding it impossible to obtain the chemicals needed for operating rapid filters or chlorinating plants. This might result in the deaths of hundreds and possibly of thousands from the epidemics of typhoid that would undoubtedly occur in many of the cities.

It is to be presumed that the United States Public Health Service presented these facts and arguments to those in charge of freight regulation in requesting that such chemicals be placed on the priority list. There are millions of tons of material on this list, the importance of most of which to the country is nothing like so great as that of these water purification chemicals, if the lives and health of the citizens are considered of first importance. If lives are lost through this refusal of Washington officials to do their part towards facilitating the delivery of these chemicals to the cities needing them, those officials could justly, in our opinion, be held morally responsible for these deaths.

An insignificant number of cars a day out of the many thousands which are used by the railroads would deliver all of the chlorine needed by all of the cities, and would handle all of the alum required. The transportation facilities required for this conservation of the health and lives of water consumers of the country would withdraw from the transportation of coal and other commodities on the priority list an unappreciable number of those being used for this purpose.

The only excuse that we think of as being offered by these officials is that, if they grant priority to these chemicals, it will be used as an argument by others in asking for similar favors. We think of few others which would have anything like equally strong arguments to offer; and if there are others with arguments as valid, they also should take precedence over coal, a considerable percentage of which is being used for the manufacture of nonessentials and luxuries.

Why Construction Lags

The long-suffering public is at present compelled to accept the conditions of unnecessarily scarce material and labor and excessive prices and in many cases is ready to pay the bills and even anxious to do so, in order to secure prompt construction to facilitate and increase industrial production and commerce.

The contractors are not put out of business by high prices or wages; they simply pass them along to the helpless owners—municipalities, individuals or corporations. So far as the government and some of the municipalities are concerned, the waste and extravagance incurred appears to matter not at all, or even to be desirable, because of the extra graft it affords to the venal politicians.

Notwithstanding all of these various difficulties, urgent and important construction and a large amount that is not vital would be progressing far more rapidly today and we would be much near an approach to resumption of normal conditions were it not for the unparalleled arrogance, unreliability and unfairness of labor unions. They are not generally amenable, as corporations, to civil processes, are generally entirely irresponsible, have the well-earned reputation of often breaking their covenants and have avowedly announced their policies of restricted labor, reduced production, excessive wages, and defiance of law without any apparent regard to the destruction of national reserves and resources that alone can supply the capital and equipment vital for sustained or increased production and prosperity.

Their motto is too often to force the last possible dollar from the public and their employers, regardless of value exchanged, and to give the least possible labor in return for the highest wages that can be extorted, and above all, to secure universally closed-shop, preventing any independent workman from earning a living, which causes many unexcusible strikes, to say nothing of the numerous disputes between the unions themselves.

The whole subject was forcibly demonstrated by the statement only a few days ago by one of the heads of a large contracting firm of the highest standing for the excellence of its work, its reliability and the generous treatment that it gives its employes.

This firm has successfully executed a large amount of private and public construction, some of it of a very difficult nature in New York and vicinity, and has now under contract an important construction of which this representative said, "I am anxious on account of the labor question, which is very bad and getting worse. Men are difficult to obtain and we never know what they will demand or if we can keep them at any price. The unions are continually making trouble and calling off their men on the slightest pretext. The other day they were called off simply because someone disliked something about the wrecking crew that were removing the old structure. Another time it was because two different unions claimed the right to do work on the same scaffold, and we had to employ one union to build the lower part and another the upper part thus doubling the cost and time to avoid a strike.

"Such conditions make us refuse much work that is offered us and that we would otherwise wish to undertake. We do not at present want large jobs for a fixed or unit price, and are chiefly taking small jobs that can be completed quickly —say in 60 days."

In addition to the entirely unjustifiable and disproportionate high prices, we instance the case of a large apartment building in New York City which was commenced last year. After the steel framework costing perhaps several hundred thousand dollars had been erected, the labor unions stopped work on the building and would not permit it to be resumed because they had objections to the contractors that had fabricated or erected the steel framework and demanded that it should be entirely torn down at a cost of many thousands of dollars by union labor, and re-erected by satisfactory union labor before they would permit the building to be completed. The owners being unwilling or unable to comply, the building has remained for months in its unfinished condition entailing great losses to the innocent owners and to the public that suffer so acutely for housing today.

Under such conditions, when the owner and the builder are at the mercy of the highwaymen and there is little or no protection or legal redress, capital that is anxious to work will, and should be, kept idle rather than submit to such extortion.

Building Roadways In Half-Width Strips

One of the features connected with highway construction which causes the officials to be annoyed by general complaints is the apparent necessity of closing the roads during construction and compelling traffic to take detours meantime. The only practicable method suggested for avoiding this is to pave one side of the middle line of the road at a time, leaving the other half open for traffic. This, of course, has its objections, one of which is a greater or less increase in the cost of construction. Another advantage claimed for this procedure in the case of concrete roads is that it gives an expansion joint along the middle of the road, where cracks are quite apt to appear; which expansion joint, showing up prominently as a black line on the white surface, is claimed to tend to keep traffic on its own side of the road and thus reduce the number of accidents.

Theoretically this appears very attractive. Unfortunately it does always seem to work out so satisfactorily. The concrete road being built in this way which is described in this issue is an illustration. The conditions here are, of course, extreme. The road carries a very heavy traffic continuously night and day, and even the presence of state police, at each end of the section under construction, to control traffic is not always successful in preventing violation of the regulations and confusion and collisions occasionally. The half-width of the road is so narrow that two vehicles cannot possibly pass on it, and it is, therefore, necessary to allow those going in one direction to use the strip for two or three minutes, holding up those going in the opposite direction, then permitting these latter to use the strip while the other line waits. Where the vehicles pass only at intervals of five minutes or so the difficulty would not be anything like so great, especially if there were shoulders on which vehicles could pass when they meet in this narrow strip. In the road in question, however, not only was there continuous traffic in both directions, but nearly a quarter of a mile of the road was on an embankment, the guard fence along the edge of which was only a few inches from the edge of the roadway, and consequently it was absolutely impossible for vehicles to pass each other.

The argument that the expansion joint down the middle of the road would tend to keep traffic on the right hand side and thus minimize the danger of collisions, although it is reported to have had this effect in some cases, as described previously in PUBLIC WORKS, is said to have had no such effect on a road in eastern New York, where traffic is reported to pay no attention to the expansion joint considered as a traffic boundary, but to travel in the middle of this highway as they do in others. Owing to these experiences it is probable that no more roads will be built in this section of New York State by this method of building half-widths.

Cost of Construction Accidents

Discussion of life, time and money lost by accidents on construction work, cost figures in percentage which it is estimated can be reduced to one-half, making in wages alone, an average saving of $27,000 per year for a 3,000-man force.

In a recent article by F. A. Davidson published in the Westinghouse, Church, Kerr & Company quarterly, the cost of construction accidents is analyzed from the standpoint of the injured persons in capacity, suffering, expense and loss of wages; the loss of services to the company, the possible effect on the efficiency of the remaining workmen, the possible psychological effect of the accidents on the uninjured workmen, cost of training new men, and increase of insurance rates.

The records of the company for the first quarter of 1919, show that during that time 237 accidents occurred on all of the jobs in progress by the company. In 212 cases a doctor's services were required, and in 147 cases the workmen lost no time excepting the remainder of the day on which the accident occurred. The remaining 90 cases were called "Lost Time Accidents," in which the workmen were off duty after the day of the accident.

LOST TIME ACCIDENTS

The 90 Lost Time Accidents were divided as follows:—

The total working time lost due to these ninety accidents amounted, in addition to the one fatal accident, to a total of 1,734 working days equal to a loss of $9,775 in wages. Each 3,000 man-hours per year represents one full time worker. To calculate a yearly accident frequency rate for any particular concern, the total number of man-hours worked during the year is divided by 3,000, which gives the number of full time workers. Then, since the total number of accidents is known, it is possible to establish an accident frequency rate which is usually expressed in terms of the number of Lost Time accidents per thousand or per hundred full time workers. The accident severity rate is usually expressed in terms of the number of days lost per Full Time Worker. Based on the records for the first three months of this year W. C. K.'s accident frequency rate is 72 Lost Time accidents per year per 1,000 full time workers.

The severity rate based on the same period of time is 3.3 working days lost time per year per full time worker, exclusive of fatal accidents, of which there was one during the first quarter.

These actual figures may seem impressive to those who have never realized the extent of accidents in construction work. They are impressive and yet it is a fact, as testified to by such statistics as are available and by general observations, that W. C. K's accident rates are considerable below the average accident figures in the construction field.

LOSS AND RATE PER MAN-HOUR

Fatal	1
Permanent partial disability	1
Caused loss of time of two weeks and over	33
Caused loss of time from one to two weeks	16
Caused loss of time of less than one week	39
Total	90

The total number of man-hours worked on a job during a month divided by 250 gives the number of full time workers on the job for the month. The yearly frequency rate divided by 12 gives 14 Lost Time accidents per thousand, or 1.4 Lost Time accidents per thousand full time workers per month, which represents the monthly frequency rate. In the same manner the monthly severity rate is 0.28 working days lost per full time worker per month. On a job requiring an average of five hundred men for six months, on an eight-hour basis with no overtime, the number of man-hours worked per month would be approximately 500×25×8=100,000 man-hours. This figure divided by 250 gives 400 full time workers per month. Applying the above rates to the assumed job, we obtain a total of 5.6 Lost Time accidents per month, with a resulting time loss of 112 working days. For the complete job lasting for a period of six months, the total accident cost will be 34 Lost Time accidents resulting in a total loss of working time of 672 working days, not including the loss of working time which would result from any fatal accident which might occur. It is certain that by earnest and sustained efforts on all jobs to prevent accidents the figures given above, which represent the present W. C. K. accident rates, can be cut in half.

ESTIMATE HELPS REDUCE ACCIDENTS

Consequently, in preparing an estimate of the cost in injured men to complete a job, the rate used should be taken as not more than half the present rates of 1.4 Lost Time accidents per hundred 250-hour workers per month with 0.28 working days lost time per 250-hour workers per month. Having established an estimate on this basis, all energies can be devoted to keeping the cost within the estimate.

Applying this plan to the job used in our illustration, it means that when the completed structures are turned over to the client there will have been saved at least seventeen Lost Time accidents and a proportionate saving of 336 working days, representing in wages saved almost $2,000. Yet this is but one average job. Provided that the same principle is applied on all of our work and it is possible to cut the present accidents rates in half, the saving in accidents in a year's time (assuming for example that there are employed during the year an average field force of 3,000 full time workers) would be about 258 lost time accidents and a proportionate saving of 4,950 working days, representing in wages saved more than $27,000, without taking into consideration any fatal accidents.

National Construction Questionnaire

Questions submitted to construction associations by Senate Committee and suggestions of the Associated General Contractors.

Just before adjournment the U. S. Senate passed resolution 350, introduced by senator Calder, providing for the appointment of a committee of five to inquire into the existing situation in relation to construction and to suggest measures for its stimulation and encouragement. The resources and opportunities of this committee make it possible for it to immensely benefit the construction interests of the country, and to help all American industry by formulating an adequate policy to meet this period of reconstruction. It provides definite leadership and authority that had previously been lacking and which should be supplemented by the coordination of every contractor, architect, engineer, manufacturer distributor, and workmen who should fully respond to all requests for information and assistance both as individuals and as associations.

The committee has issued a request to construction associations to transmit forthwith to them replies to the following questions:

1—What is your point of view regarding the condition of the general building industry today?

2—What is your opinon of the condition of the various classes of construction today, such as housing, commercial construction, highways, etc.?

3—What is the condition of your particular branch of the industry?

4—In case the situation is unfavorable in your line, please list the causes of this condition in the order of their importance.

5—What suggestions have you with regard to remedies for the above conditions?

The Associated General Contractors of America meeting in conference with about 30 other associating members of the national federation of construction, in Philadelpha, June 17, to consider the most effective cooperation with the senate's committee recommended to the latter consideration of special features as follows:

Transportation:

Priorities for materials for essential construction second only to food and fuel for essential industries during existence of shortage of transportation facilities.

Materials:

Full publicity of costs of construction materials.

Labor:

Positive encouragement of desirable immigration. Extension of Government aid to trade schools.

Finance:

Legislative measures such as equitable tax exemption, to make investment in construction attractive without further inflating the credits of the country.

In response to the request of the committee that the Associated General Contractors should aid them by giving specific information the association has issued to its members the following questionnaire that can properly be answered by any contractors or constructors regardless of their membership in the association.

QUESTIONNAIRE

1. Is your firm being held up at present in the execution of any contracts for buildings, highways, railroads, public works?

2. Does there exist a shortage of adequate construction in your locality for buildings (houses, industrial buildings, etc.) highways, railroads, public works?

To what extent? (Please be as specific as possible.)

3. Why? (Please explain as fully as possible the underlying causes of 1 and 2, including the relationship of any of the following to the present situation: Transportation, cost or shortage of materials, shortage of labor supply, high wages, strikes, finance.)

4. What effect has this shortage of construction had on the public? (Including relationship to rents, commodity prices, standards of living, etc.)

5. What has been done in your locality to remedy this situation?

6. What do you think of the means thus employed?

7. What do you think of the following suggestions as remedies for the present situation?

Transportation—Priorities for materials for essential construction second only to food and fuel for essential industries during existence of shortage of transportation facilities.

Materials—Full publicity of costs of production and distribution of construction materials.

Labor—Positive encouragement of desirable immigration; extension of Government aid to trade schools; Government machinery to settle labor disputes with power to enforce decisions; a national conference of construction employers and employees.

Finance—Legislative measures, such as equitable tax exemtion, to make investment in construction attractive without further inflating the credits of the country.

8. What other suggestions can the A. G. C. present to the Senate Committee on construction and Production?

New Municipal Piers for New York

The sinking fund commission of the City of New York has authorized expenditures for the replacement of thirty-two municipal piers and the construction of eighteen new ones on the lower part of Manhattan Island. The new piers will be from 900 to 1,000 feet long and from 100 to 150 feet in width.

The City of Davenport, Iowa, has recently created a city planning commission consisting of the mayor, the city attorney and twelve citizens.

Excavating by Power Under Building

A cellar was excavated under a completed five-story building, involving removing nearly twelve thousand cubic yards of earth.

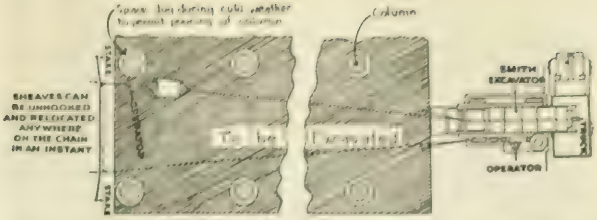
In the construction of the Wisconsin Food Products Company Factory at Milwaukee, the usual order of operations was reversed by building the 5-story factory first and afterwards making the cellar excavation of nearly 12,000 cubic yards of earth under the first floor of the building and around the foundations of the columns. Another novel feature of the work was that the soil was excavated, handled and loaded into trucks by a flexible power plant consisting essentially of a drag line scraper and hauling and excavating machine installed in successive positions so as to command all portions of the cellar area and deliver directly to the trucks by which the earth was removed.

When building operations were begun in November last, the ground was for a long time frozen so hard that excavation was difficult, slow and expensive. No attempts were made to complete the general excavation at this time and, in order to avoid delay in the building construction, the sites of the column footings were located and defined, fires built on them and. after the ground had been sufficiently thawed, holes were dug just large enough and deep enough to provide for concreting the footings. After these had been finished the superstructure was built, with the 300 x 160-foot first floor less than five feet above the surface of the ground in some places.

As the outer walls of the building were not then completed below the first floor, the area to be excavated there was easily accessible and lighted from the exterior so that work could be carried on without much difficulty when the cold weather was over and the ground was soft enough to be handled advantageously.

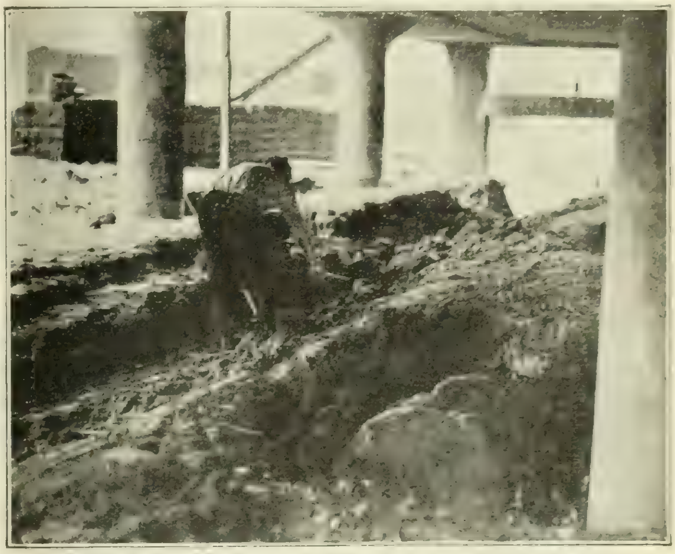
As the headroom was not sufficient for handling even a small-size steam shovel satisfactorily, a Smith excavator and loader (such as was described in Public Works, May 15, page 433) was installed and executed the work rapidly and satisfactorily.

The plant installed has a drag line scraper, guided by hand and hauled back and forth by light steel cable operated by the drum of the loading machine, to which they were attached and to two tail sheaves adjustable at any points of an anchor chain set on the opposite side of the building from the loader and easily shifted from place to place so that the back and forth motion of the scraper commanded all parts of the cellar and easily worked between and around the foundation piers and columns.

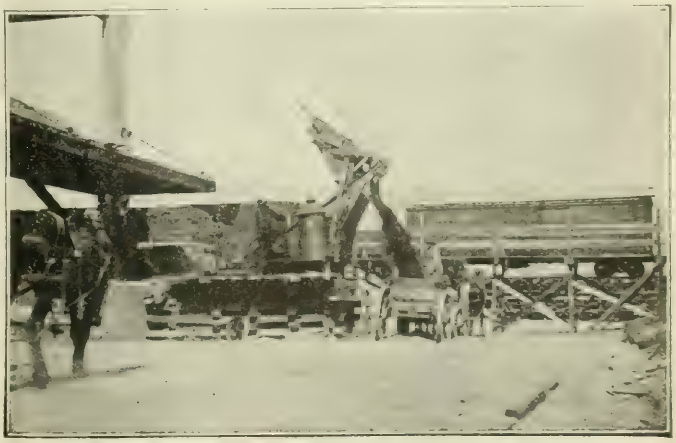

Column
SMITH EXCAVATOR
SHEAVES CAN BE UNHOOKED AND RELOCATED ANYWHERE ON THE CHAIN IN AN INSTANT
STAKE
STAKE
To be Excavated
TRUCK
OPERATOR
180 feet

ARRANGEMENT OF POWER PLANT EXCAVATING UNDER FINISHED BUILDING

The loader was set just outside the building on the center line between two rows of columns and was itself shifted from panel to panel as required. At the opposite end of the building, 180 feet away, the anchor chain, perpendicular to the column rows, was secured to two stakes about 20 feet apart, (on centers of column rows) and two sheaves or snatch blocks were hooked to it and shifted from time to time to vary the path of the scraper until the area between these two rows of columns had been excavated, after which



OPERATING DRAG LINE SCRAPER UNDER FLOOR



EXCAVATOR DUMPING CONTENTS OF DRAG LINE SCRAPER INTO TRUCK the apparatus was moved to the next panel of the building and excavated it, and so on.

The loader was mounted on cribwork built up from the bottom of a depression in the surface of the ground about 6 feet below the basement floor. This machine had a platform carrying the hoisting engine, and an incline at the top of which there was a chute delivering into the trucks that were driven up alongside the machine. The scraper, being hauled up to the machine, was revolved upwards over the incline and reversed so as to dump into the chute, after which it was returned to the surface of the ground and drawn back by the tail line, ready for a new load. The apparatus was operated by two men and, although considerable time was lost because there were not enough trucks available to keep it busy, it handled an average of 30 cubic yards of spoil per hour. The excavation was done by the Water W. Oefleim Co. contractor.

Tunneling for a Culvert

A 30-inch culvert pipe 120 feet long and 14 feet below the surface of the ground was installed crossing at right angles under a railroad, two borrow pits and a highway in Stanislaus County, California, by the tunnelling method without disturbing the surface or interrupting the traffic at the intersections of the highway and railroad.

The pipe, for a portion of a syphon, was required to be watertight and is located below a hardpan stratum that doubtless facilitated the special method of construction adopted. Pits were excavated at both ends of the syphon and were drained by a 4-inch and a 2-inch centrifugal pump operated by a 2½ h.p. gas engine.

Armco corrugated pipe sections were riveted up at one end of the syphon to a length of 60 feet, placed in the required alignment and elevation and then forced longitudinally and horizontally under one borrow pit and the railroad track by one man excavating in the interior of the pipe and 4 assistants who removed the muck and operated a 50-ton jack by which the pipe was driven forward its full length.

In a similar manner a 40-foot length of corrugated pipe was driven in the opposite direction from the pit on the other end of the syphon and passed completely under the railway to a point within 20 feet of the forward end of the first pipe. The space between the two corrugated pipes was filled by five 4-foot lengths of concrete pipes 30 inches in diameter which together made a continuous horizontal section of syphon 120 feet long connecting at each end with a covered concrete well or manhole with a 30-inch pipe connection on the opposite side.

The tunnelling operations were completed in a day and a half without the interruption of traffic although as a precautionary measure, trains were slowed up during one day.

Nothwithstanding the friction and resistance developed by the exterior corrugated surface of the pipe, it was forced into position without serious difficulty and without causing any settlement in the railroad or highway. The work was executed under the direction of R. V. Neikle, chief engineer of the Curlock Irrigation District.

Isham Randolph

Isham Randolph, consulting engineer, died in Chicago, August 2. Mr. Randolph had been for 52 years in active engineering service, commencing as an axeman on railroad location and becoming successively resident engineer and construction engineer on several roads, chief engineer of the Chicago and Western Indiana Railway, chief engineer of construction of the Chicago, Madison and Northern Railway, and consulting engineer for various important corporations. He established an extensive consulting practice in Chicago, was one of the board of consulting engineers of the Panama Canal and chairman of the Internal Improvement Commission of Illinois.

He was for fourteen years chief engineer of the Sanitary District of Chicago, in charge of the famous thirty mile drainage canal the construction of which developed many new features of heavy engineering operations.

He was also consulting engineer for the Little river drainage district of Cape Girardeau, Missouri, and chairman of the Florida Everglades Engineering Commission. He was past president of the Western Society of Engineers.

Fred W. Gow

Fred W. Gow, a prominent waterworks builder, died at his home in Medford, Mass., July 28th, at the age of 56.

He had been connected with the Medford Water & Sewage Commission for 30 years, was made superintendent of the Medford Water & Sewage System in 1900, holding the position for 15 years and greatly improving it. From 1907 to 1915, he was a member of the Water & Sewage Board, being chairman for several years.

He was one of the members of the Charles R. Gow Construction Company, general contractors that built many of the largest filter beds and filtration plant in Massachusetts, including those at Lowell and Springfield. He was a member of the New England Waterworks Association and of the American Waterworks Association.

H. C. Ostermann

H. C. Ostermann, vice president and field secretary of the Lincoln Highway Association died suddenly, June 8, 1920. Mr. Ostermann was very prominent, efficient and enthusiastic in the promotion and construction of the 3,000 mile transcontinental Lincoln Highway and during his later years devoted himself exclusively to the great commercial achievement of creating an improved highway from the Atlantic to the Pacific.

Mr. Ostermann was born in Tell City, Indiana in 1876 and became self supporting at the age of 10. He enlisted in the U. S. Navy and after a varied and adventurous career, including practical railroad experience, entered commercial business in Chicago and after becoming interested in the automobile business in 1910 offered his services to the Lincoln Highway Association in 1913 since which time he has been prominently identified with it.

Highway Engineering and Transport Instruction

The University of Michigan, probably the only educational institution offering graduate short period courses arranged especially for men engaged in the practice of highway engineering and highway transport, has announced the following:

1920-1921 SCHEDULE OF GRADUATE SHORT PERIOD COURSES IN HIGHWAY ENGINEERING AND HIGHWAY TRANSPORT

DECEMBER 8 TO 21, 1920

C. E. 76. Highway Engineering, Theory, Design and Economics. Professor Blanchard.
C. E. 78. Grading Machinery and Operations. Professor Bateman.

DECEMBER 27, 1920 TO JANUARY 7, 1921

C. E. 67. Highway Transport Surveys. Professor Blanchard.
C. E. 71. Highway Specifications, Contracts, and Jurisprudence. Professor Riggs.

JANUARY 10 TO 21, 1921

C. E. 72. Earth, Sand-Clay, Gravel and Broken Stone Roads. Professor Bateman.
C. E. 81. American and English Highway Transport Methods. Professor Blanchard.

JANUARY 24 TO FEBRUARY 4, 1921

C. E. 68. Bituminous Surfaces and Bituminous Pavements. Professor Blanchard.
C. E. 74. Bituminous Materials. Professor Bateman.
C. E. 80. Interrelationship of Highway, Railway and Waterway Transport. Professor Riggs.

FEBRUARY 7 TO 18, 1921

M. E. 40. Mechanism, Operation and Maintenance of Motor Trucks, Tractors and Trailers. Professor Lay.
C. E. 69. Highway Laboratory Research. Professor Bateman.
C. E. 70. Highway Structures. Professor Gram.
C. E. 79. American and English Highway Traffic Legislation and Regulations. Professor Blanchard.

FEBRUARY 21 TO 25, 1921

Seventh Annual Michigan Conference on Highway Engineering.

FEBRUARY 28 TO MARCH 11, 1921

C. E. 73. Brick, Cement-Concrete, Sone Block and Wood Block Pavements. Professor Bateman.
C. E. 75. Highway Engineering Seminar. Professor Blanchard.
C. E. 82. Highway Transport Management, Costs and Record Systems. Professor Blanchard.

MARCH 14 TO 25, 1921

C. E. 77. Highway Engineering Financing, Administration, and organizations. Professor Blanchard.
C. E. 83. Highway Transport Seminar. Professor Blanchard.

Federal Aid Roads

The Chief of the Bureau of Public Roads, Thomas H. MacDonald, has recently stated that road operations under the Federal Aid Road Act thus far initiated totalled 29,319 miles, or nine times the distance from New York to San Francisco; also, that the federal government's share will cost more than the Panama Canal. Sixty per cent of the cost of roads which have been approved for federal aid will be spent for bituminous concrete, portland cement concrete and vitrified brick, the total of such roads approved for federal aid being 7,600 miles or more than half as much as the total milage of this class of roads in the United States before the federal aid road law was passed. The estimated cost of the approved projects is $384,900,000, and that of the projects already in various stages of construction or entirely completed is about $200,000,000.

Immigration Notes

The number of immigrants arriving at Ellis Island in the last week of July was only 10,615 as compared with 13,965 in the previous week, thus showing a drop of 3,310 which was partly due to the small number of large ships that landed passengers here during the week. A large proportion of the 1,132 steerage passengers on the Baltic were Irish girls and the majority of the 1,371 on the Moordam consisted of Jewish women and children freed from the Bolsheviki.

According to F. J. Raymond of the Inter-Racial Council, the number of the immigrants arriving in the United States since the armistice has exceeded the number of aliens departing by only 37,621, and in the year ending June 20 last, emigration exceeded immigration by more than 6,000. Last year 86 per cent of those who returned to Europe were able bodied men and only 76 per cent of the immigrants were producers. The male aliens who left the country last year each carried away an average amount of $3,100 which had been earned or accumulated in this country. It is, therefore, no wonder if foreigners are eager to emigrate and they should be assisted and encouraged, a necessity that is self-evident in view of the fact that more than 62 per cent of American labor is foreign born.

The general policy of daily papers throughout this country seems to be strongly in favor of encouraging an increasing labor immigration. One paper, quoting the Boston Transcript's estimates of 6,000,000 workers ready to leave Europe for America, immediately opportunity is afforded them, calls attention to the estimated shortage of 4,000,000 laborers that are now urgently required in this country, and deplores the restrictions that are imposed at both ends of the route. It concludes "that the future of American industry demands a clear admission of aliens; that none of the present restrictions, with the possible exception of the literacy test, should be modified until our quarantine stations are, beyond all hazards, able to guarantee the nation against the entrance of epidemic disease." This may well be supplemented by the further requirements that we shall be guaranteed against the admission of Bolshevists and other mischievous radicals.

The statement from Tacoma, Washington, that there has been definitely located an underground system on the Pacific Coast by which thousands of Japanese are smuggled into the United States yearly although perhaps not proven, is a positive indication of the fact that such labor is in demand, and will no doubt be used in a political argument in the campaign now being strongly maintained on the Pacific Coast to prevent the entrance of Asiatics and especially to deny them the right of owning land in this country.

If the statements are proved that the Japanese employees in agricultural work almost invariably injure the land and reduce its production so as to depreciate the value and enable them to acquire title at a very small amount, after which they build it up for their own interest, some such restrictions may be proper, but it should be made without prejudice to the supply and employment of large numbers of laborers for agricultural and construction purposes.

The House Committee on Immigration and Naturalization has been in session for several weeks in California, Oregon and Washington and has received testimony that Japanese farmers in the state of California have increased from 4,500 in 1912 to 19,043 in 1918. Under proper restrictions these men are valuable farm laborers and a way should be found to utilize their services without lowering the standard of living, thus increasing the opportunities for skilled labor, without the drastic legislation intended to wholly prevent Japanese immigration.

If the United States does not take active measures to secure its share of the excess labor in European countries, especially in the war zone, it may find itself unable to secure even what it is willing to accept, for other countries welcome them more freely and have within recent years attracted large numbers. For instance, Brazil has received 1,015,883 immigrants during the twelve years ending with 1919, of which the largest number were Portugese, ex-Spanish, Italians and Russians.

Immigration for July

During the five weeks beginning June 25 and ending July 30, 1920, the total number of third-class passengers landing at Ellis Island was 84,492, and the number of third-class passengers departing was 63,219, an excess of 21,273 third-class passengers arriving.

It is estimated that approximately two-fifths of those arriving and one-third of those leaving are women and children. This would be equivalent to the arrival during this period of about 50,695 men, and a departure of 42,146, a net immigration of men amounting to 8,528, or at the rate of 1,700 per week. There is no present method of determining what proportion of these third-class passengers, going or coming, are citizens of the United States.

An Abundant Labor Supply

This country is conceded to be lacking 4,000,000 or 5,000,000 laborers, which even in the most favorable ante war times could not have been secured by immigration in less than four or five years and which would now require to be in excess of such immigration. It is important to note that there exists a great reservoir of competent and reliable cheap workers in Japan, where the population, which in 1915 was more than 55,000,000, had a density of 376 per square mile, much more than the principal European countries and already too great for the agricultural resources, only 35 per cent of the land being suitable for agricultural purposes. It is, therefore, necessary for Japan to find an outlet for a large number of her workers who, under proper restrictions, should be heartily welcomed here.

Plentiful Labor in Massachusetts

The officials of the eastern Massachusetts Street Railway Company, in opposing before the board of arbitration a wage increase demand by its employees, have established the fact that there is now in that locality a plentiful supply of labor, that its employes, some of whom have been working for the company from twenty to forty years, are generally in good circumstances, 147 of them owning automobiles and 23 per cent owning their own homes. Further, they state that during the last year, 10 of the divisions of the system have shown a deficit of $68,000 to $217,000 each, and only one, that of Fall River, has earned any net income. The road now has a fair schedule fully as high if not higher than other roads in that part of the country and has reached the maximum which the public will submit to. Therefore the company believes that no arbitrary increase of wages should be imposed but that the situation should be governed by the natural law of supply and demand.

Abundant Farm Labor in California

It is reported from San Francisco that abundant labor is available in California to harvest all crops and that agricultural wages are so high there that the net earnings of farm workers are greater than those of mill and factory workers.

It is further stated that in some industries production is smaller and increasing unemployment is tending to secure a resumption of the normal operation of demand and supply.

High farm wages are offset by high prices for farm products, but if the wages increase too high, the farmers are prepared, it is announced, to revert to grazing, thus diminishing their labor needs, giving their land a needed rest, and directly increasing the amount of labor available for construction purposes.

The Jeffersonville Municipal Fire Department threatens to go on strike unless its demands are granted for salary raise of $10 a month and four days off or $5 a month and eight days off. The city officials say that the municipal revenue will not permit the consideration of the firemen's demand. If the men can get more satisfactory employment elsewhere they should resign as fast as their places can be filled, but it should be unthinkable to have a possibility of a strike in the fire department that might subject the city to great danger.

Recent Legal Decisions

PROVISION REQUIRING ROAD TO BE KEPT IN REPAIR

Where a party contracts with a county to construct a certain road and to maintain it in a state of repair specified in the contract and for a period of time provided for in the contract, and fails to comply with the provisions of the contract as to maintaining the road in a state or repair, and the county is compelled, on his refusal to do so, to place it in a proper state of repair, the Oklahoma Supreme Court holds, Gibson v. Board of Commissioners of Okfuskee County, 189 Pac. 745, that the contractor and his bondsmen will be held liable for the cost of such repair, and where the verdict of the jury is reasonable, and it is reasonably supported by the evidence in the case, the verdict will not be disturbed on appeal.

WAIVER OF PROVISION TO GUARANTEE PAYMENT FOR LABOR AND MATERIALS

Where a contract for the construction of a school building expressly makes the specifications a part of the contract, a stipulation in the specifications requiring the contractor to give a bond guaranteeing payment for labor and materials is a part of the contract. But the school board may waive this provision and it is held, Builders' Material & Supply Co. v. J. B. Evans Const. Co., (Mo.) 221 S. W. 142, that a school board did waive such a provision by taking a bond which merely indemnified it against loss, damage, liens, etc., and that the surety on such bond was not liable to one furnishing materials to the contractor.

PROVISION FOR PAYMENT OF CLAIMS OF MATERIALMEN

The Ohio statute, section 1203, General Code, relating to the procurement of a bond by the state highway commissioners, contained two provisions, one mandatory, requiring a bond conditioned that the contractor should perform the terms of the contract; another permitting the inclusion therein of a provision for indemnity against liens and claims for material and labor furnished in the construction of the improvement.. The Ohio Supreme Court holds, State ex. rel. Marble Cliff Quarries Co. v. Watts, 126 N. E. 407, that these provisions of the act did not deprive the commission of the power to include in the bond a clause for the payment of claims accruing to materialmen and laborers on account of the construction of the improvement. Such included clause, since not prohibited, is justified, being within the purpose and scope of that provision of the act which permits the commissioner to include in the bond a provision for indemnity against liens and claims for material and labor furnished. It was developed in the record that a part of the material furnished the contractor by the Quarries Company for the construction of the road was diverted by the contractor to other purposes. The material so diverted was supplied to him "on account of the construction of said road," and the diversion neither relieved the contractor from his liability to the materialman nor the sureties from their liability for the payment of claims accruing in favor of such materialmen.

LIABILITY OF TOWN TO HIGHWAY CONTRACTORS

The New York Supreme Court, Special Term, Westchester County, holds, Coyne v. Town of Greenburgh, 110 Misc. (N. Y.) 598, 182 N. Y. Supp. 20, that under New York Laws 1892, c. 493, § 6, requiring avenue extension commissioners to ascertain the cost of opening, constructing and grading, and damages for lands taken, and providing that the amount "so ascertained" be paid by the town by the issuance of bonds, to be delivered to the commissioners, a town, issuing bonds and delivering them to the commissioners, thereby paid the amount "so ascertained", and was not liable to a contractor. The town was not required to pay to the contractors, but to deliver the bonds to the commissioners, whose duty it was to apply them in payment to the contractors.

IMPROVING ROADS "STRICTLY COUNTY PURPOSES"

The Washington Supreme Court holds, Rust v. Kitsap County, 189 Pas. 994, that whether a designated indebtedness is for a public purpose under article 8, section 6 of the state constitution is in each case a proposition finally to be determined by the courts and not the Legislature, though the legislature determination is entitled to great weight and will be upheld unless it plainly appears, beyond any reasonable doubt, to be mere pretence or dissimulation. A county was held to have the right to issue bonds for the purpose of constructing, repairing and improving roads within the 1½ per cent. limitation without authorization from the people under the Washington statute; such purposes being strictly county purposes within the constitution.

CONTRACT FOR CEMENT FOR HIGHWAY WITHOUT ADVERTISEMENT HELD VOID

The California Supreme Court holds, Henry Cowell Lime & Cement Co. v. Williams, 189 Pac. 838, that California St. 1913, p. 667, adding subdivisions 21 and 22 to section 4041 of the Political Code, and authorizing the employment of a purchasing agent to purchase certain county supplies and all other personal property or supplies, and providing that it shall not be necessary to advertise for bids for furnishing county supplies as required by section 4048, does not dispense with the advertisement for bids in purchasing cement for a highway improvement, as the clause "and all other supplies" is limited by the context to ordinary county supplies. Therefore a contract by a county purchasing agent for cement for a highway improvement which was made without advertising for bids in violation of the express requirement of the statute was held void, and the seller could not recover thereon.

NEWS OF THE SOCIETIES

August 24-26—LEAGUE OF CITIES OF THE THIRD CLASS IN PENNSYLVANIA. Annual convention York, Pa. Secretary, Fred H. Gates, Wilkes-Barre, Pa.

August 25-27—UNION OF NOVA SCOTIA MUNICIPALITIES. Annual convention August 25-27. Secretary, Arthur Roberts, Bridgewater, N. S.

Sept. 1-3—MICHIGAN STATE GOOD ROADS ASSOCIATION. Annual meeting, Lansing, Mich. President, P. T. Colgrove, Hastings, Mich.

Sept. 7-10—NEW ENGLAND WATER WORKS ASSOCIATION, Annual convention, Holyoke, Mass. Secretary, Frank J. Gifford, 715 Tremont Temple, Boston, Mass.

September 13-16—PACIFIC COAST ASSOCIATION OF FIRE CHIEFS. Annual convention Los Angeles, Cal. Secretary, H. W. Bringhurst, Seattle, Wash.

September 13-17—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual meeting San Francisco, Cal. Secretary, A. W. Hedrich, 169 Massachusetts Ave., Boston, Mass.

Sept. 16-18—ENGINEERING INSTITUTE OF CANADA. Meeting to be held at Niagara Falls, Ontario.

Sept. 20-23 — SOUTHWESTERN WATER WORKS ASSOCIATION, Annual convention, St. Charles Hotel New Orleans, La. Secretary, E. L. Fulkerson, Waco, Texas.

Oct. 12-14—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. St. Louis, 401 Lincoln Avenue, Valparaiso, Ind.

October 13-15—AMERICAN CIVIC ASSOCIATION. Annual convention Amherst, Mass. Secretary, E. F. Marshall, Union Trust Bldg., Washington, D. C.

October 16-19—AMERICAN COUNTRY LIFE ASSOCIATION. Annual conference Springfield, Mass. President, Kenyon L. Butterfield, Amherst, Mass.

Oct. 19-22—INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. 25th annual convention, New Orleans, La. Secretary, C. R. George, Houston, Texas.

GOOD ROADS MEETING IN NORTH CAROLINA

Representatives from twenty-six counties in North Carolina attended the first session of the citizens' mass meeting at Raleigh, Aug. 10, in the interest of good roads.

Following the address of welcome by Mayor T. B. Eldridge, of Raleigh, and the response of James Cowan, of Wilmington, substituting for Wade H. Phillips, of Lexington, who was reported absent because of bad roads, T. L. Kirkpatrick, of Charlotte, stated the object of the gathering.

Col. Kirpatrick declared that the idea upon which the meeting was grounded was to crystalize sentiment in favor of a state trunk system of modern highways, connecting every county seat in North Carolina. The convention was urged to adopt some measure with a view of placing North Carolina in the forefront of the other forty-seven states.

Special interest attached to the night session when rival gubernatorial nominees, Cameron Morrison, Democrat, and John J. Parker, Republican, spoke for good roads.

MATERIALS HANDLING SECTION OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

The largest and one of the oldest technical organizations of the country, The American Society of Mechanical Engineers, has formed a Materials Handling Section whose object is to "promote the art of the mechanical handling of all materials."

A meeting was held at the Engineering Societies Building, 29 West 39th St., at 2:30 P. M., August 13, 1920. Robert M. Gates, of the Lakewood Engineering Company, managing engineer specializing in material handling equipment, presided. The meeting was addressed by Harold V. Coes, industrial engineering specialist, of Ford, Bacon & Davis, F. M. Fieker, vice-president of the McGraw-Hill Publishing Co., and E. Logan Hill, formerly secretary of the Port and Harbor Facilities Commission of the U. S. Shipping Board, also formerly assistant general manager of the Erie Railroad.

Mr. Gates said: The soaring costs of today are not resulting alone in increase in the price of the commodity but are the results of increased costs of handling of production. The inefficiency of the freight handling system of these United States cannot be laid upon a lack of equipment but a lack of adequate means of loading or unloading and more effective means of filling cars to capacity and the providing of suitable warehouse facilities. These are acknowledged facts—facts that have been expressed and known for some time. We then ask ourselves what is being done to eliminate the difficulties. To date organizations and individuals have endeavored to encourage a correction of present conditions all with more or less beneficial effect, but so far there has been no common nationally known organization which all other institutions or individuals could turn to help correlate the effort on this subject.

There are but two ways of doing this work—manually and mechanically. The manual system can never be wholly dispensed with but it has been proven that it is utterly unable to cope with the situation. Therefore the salvation of our industrial and commercial life is dependent upon the development of the mechanical means of material handling and the fitting it into economic conditions of today.

THE NORTH CAROLINA SOCIETY OF ENGINEERS

The annual convention of the North Carolina Society of Engineers was held at Asheville, August 12-14th. Among the principal subjects considered was the passage of a bill by the next state legislature to secure the licensing of engineers and surveyors. A paper on this subject was presented by Chas. E. Waddell. Another paper on the State Water Resources was presented by Frederick W. Myers, and an excursion was made to the Pisgah National Forest.

AMERICAN ASSOCIATION OF ENGINEERS

The American Association of Engineers has inaugurated a 1920 membership campaign to extend from Sept. 15 to Oct. 30 and offers a large number of prizes ranging from a membership certificate to a gold watch or a life membership to those individuals which bring in the largest number of new members. Special rivalry has been developed between several important cities and it is expected that in New York City alone, the membership will be increased to 2,500.

The Illinois Assembly has been organized with 10 member chapters, Chicago, Danville, Decatur, Effingham, Joliet, Mattoon, Peoria, Rockford, Springfield, Rock Island. Robert C. Bruce of Joliet was elected president, Henry Riedl of Chicago, vice-president, Thomas E. Lowery of Springfield secretary, and E. H. Michaelis, Rock Island, Treasurer.

The Washington State Assembly will be permanently organized at a state convention to be held in Everett, Washington, on Aug. 24. A constitution will be adopted and permanent officers elected. The convention is expected to approve a proposed state license law which has been under preparation by the assembly license committee for several months. Courtland Penny is secretary of the assembly.

Chapter charters have been granted to members in Poughkeepsie, New York, and Jefferson City, Missouri, and a club charter in Rutland, Vermont.

The Chicago Chapter has requested the mayor of Chicago to remove from office Commissioner of Public Works Francis and the three members of the Chicago Civil Service Commission. This action was taken on August 6 as a result of the discharge from the employ of the city of Thomas G. Pihlfeldt, city bridge engineer for many years, and his assistant, Hugh E. Young, through a "trial" which the chapter characterizes as farcical and an exhibition of spoils politics. In commenting upon the chapter's warning to engineers against accepting positions in city employ, the Chicago Daily News says, editorially, "After the experience of Messrs. Pihlfeldt and Young that warning seems scarcely necessary. Engineers who have a regard for their personal reputations and professional standing will hardly choose to subject either to gratuitous attack by entering a service in which political influence apparently counts for very much more than does faithful work for the public."

DULUTH ENGINEERS' CLUB

At its meeting of Aug. 2nd, the Duluth Engineers' Club elected as officers; President. W. S. Hearld; first vice-president, O. B. Bjorge; second vice-president, Ray S. Huey; secretary, Geo. C. Olmsted; treasurer, A. U. Shipman; directors, A. M. Frazee, Frank Hutchinson, W. J. Mathews, Col. F. A. Pope; representative on the Minnesota Joint Engineering Board, W. H. Woodbury; delegate to Organization Committee of the Minnesota Federation of Engineers, J. L. Pickles.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

The 1920 annual meeting of The American Society of Mechanical Engineers will be held in the Engineering Society Building, 29 West 39th Street, New York City, from December 7 through December 10th. Sessions will be held on the subjects of appraisal and valuation and the application of engineering to woodworking.

The newly founded professional sections on management, power, fuels, machine shops, railroads and textiles will also conduct sessions to consider the vital problems in their field. In addition a number of valuable papers will be presented at General Sessions.

A memorial session for Dr. Brashear is planned, as a fitting tribute to his life and work.

BRANCHES OF ASSOCIATED GENERAL CONTRACTORS OF AMERICA

Oklahoma—Oklahoma City, Okla.

Officers: President, J. W. Maney Vice President, R. D. Farmer; Treasurer, M. A. Swatek; Secretary, R. G. Marriott.

Saint Joseph, Missouri.

Officers: President, P. P. Buddy; Vice President, Sam Hotchkiss; Treasurer, Chas P. Norris; Secretary, John H. Vincent, 717 Corby-Forsee Bldg., St. Joseph, Mo.

Southern California—Los Angeles, Cal.

Officers: President, Arthur Bent; Vice President, Clare L. Peck, of Leonard & Peck; Treasurer, J. F. Atkinson; Secretary, George A. Rogers, of Rogers Brothers Co.

Executive Committee: Arthur Bent, Clare L. Peck, George A. Rogers, Godfrey Edwards, R. F. Ware, J. C. Edwards and Frank Foell.

San Francisco, Cal.

Officers: President, Henry Jacks; 1st Vice President, John Biller; 2nd Vice President, P. J. Lynch; Treasurer, Charles Wright; Secretary, E. T. Thurston.

Directors: Henry Jacks, John Biller, P. J. Lynch, Thomas Elam, Charles Wright, C. M. Moore, A. H. Wilhelm.

Pacific Northwest—Portland, Oregon.

Officers: President, Natt McDougall, A. Guthrie & Co., Portland, Ore; Vice President, R. E. Miller, Puget Sound Bridge & Dredge Co., Seattle, Wash.; Secretary-Treasurer, I. N. Day, A. D. Kern & Co., Portland, Ore.; Executive Secretary, J. D. MacVicar.

Directors: Natt McDougall, R. E. Miller, I. N. Day, J. A. McEachern, D. G. Monro, General Construction Co., Spokane, Wash.; A. E. Griffin, Stewart & Welch, Vancouver, B. C.; G. W. Gauntlett, Grays Harbor Construction Co., Hoquiam, Wash.; Herman Goetz; A. H. Toole, Clifton, Applegate & Toole, Spokane, Wash.; K. B. Kumpe, Warren Construction Co., Portland, Ore.; Charles Swigert, Pacific Bridge Co., Portland, Ore.

Nashville, Tennessee.

Officers: President, J. W. N. Lee; Vice President, E. G. Holladay; Secretary, John A. Wilson, 177 Second Ave., N., Nashville, Tenn.

Northwestern—St. Paul, Minnesota.

Officers: President, W. O. Winston, Winston Brothers Co., Minneapolis, Minn.; First Vice President, Charles Ffolliott, A. Guthrie and Co., St. Paul, Minn.; Second Vice President, H. N. Leighton, H. N. Leighton Co., Minneapolis, Minn.; Third Vice President, R. P. Grant, George J. Grant Construction Co., St. Paul, Minn.; Treasurer, Claude H. Siems, Siems, Helmers and Schaffner, St. Paul, Minn.; General Secretary, H. H. Weston.

Directors: F. J. Walsh, Walsh Construction Co., Davenport, Iowa; J. A. McEachern, J. A. McEachern and Co., Seattle, Wash; Nelson Story, Jr.; F. H. Romer, F. J. Romer Construction Co., St. Paul, Minn., W. E. McCullogh and Cheney Co., Minneapolis, Minn.; M. W. Barnard, Minneapolis, Minn.; J. R. Stack, Stack Construction Co., Duluth, Minn., L. A. Baumgardner, L. A. Baumgardner and Co., St. Paul, Minn.; E. T. Foley, Foley Brothers Co., St. Paul, Minn.

ENGINEERING INSTITUTE OF CANADA

The next meeting of the Engineering Institute of Canada at Niagara Falls, Sept. 16, 17-18 will be devoted largely to papers on the new Chippewa-Queenstown development of the hydro-electric power commission of Ontario around Niagara and the Welland ship canals, both of which works will be visited by the delegates to the Convention.

CANADIAN POWER COMMISSION

A government commision to control water power in the province of New Brunswick, Canada, has been organized under the title of the New Brunswick Hydro-Electric Commission, E. O. Foss, St. John, chief engineer. The program includes the developments of two water powers for St. John and one for the North Shore.

PROBLEMS THAT CITIES ARE SOLVING WITH EXPERTS

The city council of Elgin, Ill., has engaged D. H. Maury, Chicago, to make a preliminary survey of the local water supply conditions

The Mayor of Philadelphia has appointed a zoning commission of 18 members including Geo. S. Webster, Chief of the Bureau of Survey; John A. Vogelson, Chief of the Bureau of Health and John B. Sinkler, city architect; Walter F. Ballinger, representing the Philadelphia Engineers Club and Edgar V. Seeler representing the American Institute of Architects. There are also representatives of the Master Builders Exchange and of the Central Labor Union.

A report on the water supply required for Philadelphia during the next 50 years is to be made by a commission of experts including J. Waldo Smith, George W. Fuller, J. W. Ledoux and Joseph F. Hasskarl who are expected to make a preliminary statement by September 15th.

PERSONALS

Holden, E. H. consulting engineer to the city of Yonkers, New York, and assistant engineer, Topographical Bureau, Borough of the Bronx, New York, died August 7th.

Sheppard, D. C., one of the contractors for the Great Northern & Pacific Railroads, died recently at St. Paul, Minnesota.

Helm, A. A., has been appointed resident engineer, Federal Aid Project 11, Franklin County, Kansas, headquarters at Ottawa, Kans.

Lenz, C. O., has been appointed consulting engineer to the Foundation Company, N. Y.

Atkins, Dudley, Jr., has been appointed resident engineer Federal Aid Project 53, Donaphan County, Kans., headquarters Troy, Kans.

Wilmot, Lieut. F. E., has been appointed resident engineer for the republic of Santo Domingo.

Davey, W. B., has been appointed city engineer, New Orleans.

Adams, Major F. P., has been appointed city engineer, Brantford, Ontario, Canada.

Simpson, Robert, has been appointed city engineer of Columbus, Ohio.

Anderson, W. E., has been appointed engineer of the Irrigation District, at San Benito, Texas.

McAdams, E. E., has been appointed city manager, Bryant, Texas.

Hines, Frank T., Brig-Gen., chief of the bureau of Transportation of the U. S. War Department, has been appointed head of the Inland and Coastwise Waterways Service.

Edwards, D. G., has been appointed director of construction of 1⅛ miles of Intercontinental Construction in Brooklyn.

Kramer, X. A., has resigned as state engineer of Mississippi.

Cureton, Ralph, has opened an engineering office in Greenville, S. C., Mitchell, Gen. C. H., has been appointed member of the commission to investigate and report on the Ontario Hydro-radial system

Stephens, U., assistant bridge engineer of the Texas Highway Department has been appointed resident bridge engineer, Runnels County, Texas in charge of a bridge across the Colorado River near allinger, Texas.

Caven, F. H., has been appointed director of public works of Philadelphia.

Brown, Fred, has been appointed city engineer of Muskegon, Mich.

Davey, W. B., has been appointed city engineer of New Orleans, La.

W. A. Olen, president of the Four Wheel Drive Auto Company, with D. J. Rohrer and C. F. Folkman, members of the Board of Directors sailed for England, August 14th, in the interest of the company's foreign business

While abroad they will make a study of the truck situation with a view to improving present facilities of the company for handling its increasing export trade. The party will join Senator Anton Kuokuk, also a director, who is abroad at present.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

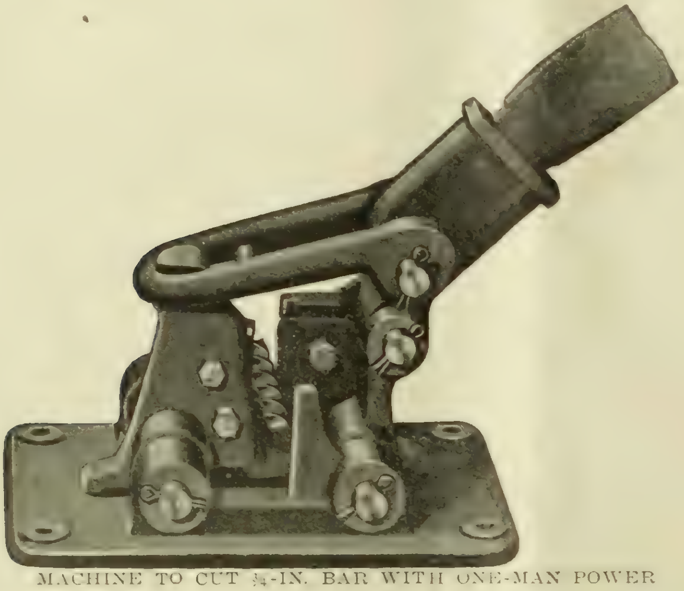
HAND CUTTERS AND BENDERS

Catalog 22 of Koehring Machine Company illustrates two sizes of hand-power cutters for reinforcement bars. Size 1, weighing 100 pounds, will cut up to ¾-inch round or twisted bars; and size 2A weighing 70 pounds, will cut up to 1¼-inch round or 1⅛-inch twisted bars. Bars up to ¾-inch square can be cut by one man, larger sizes require two men.

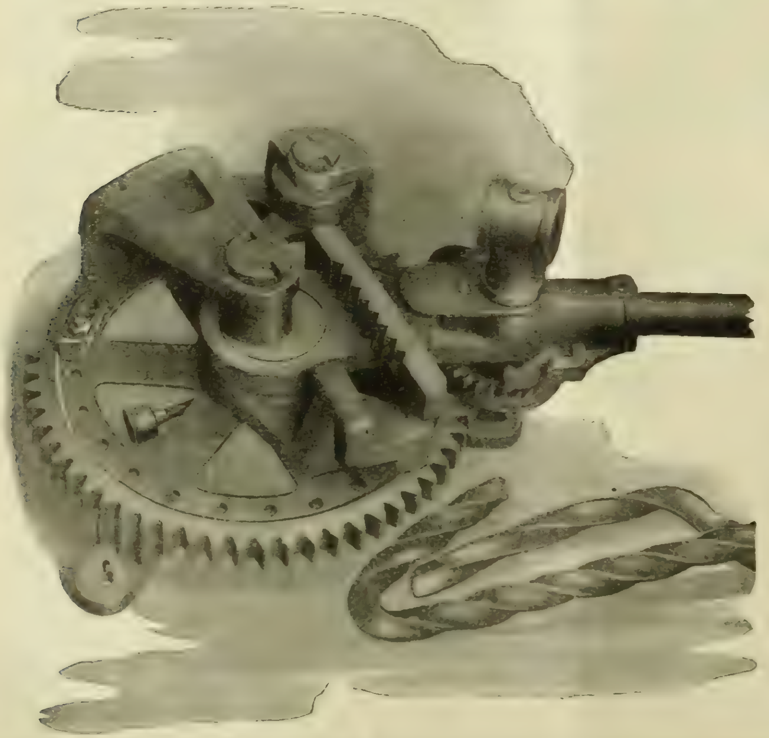
The jaws are arranged so as to act more powerfully as the cut progresses and make a clean, square cut without fracture.

Hand-bending machines are also made in two sizes weighing 105 to 225 pounds without the handles, and with capacities up to 1¼ and 1½-inch diameter bars.

In the small size the die is 2 inches in diameter and has a roller bearing journal. The guide block has a large roller which reduces friction and permits the bar to follow freely.



MACHINE TO CUT ¾-IN. BAR WITH ONE-MAN POWER

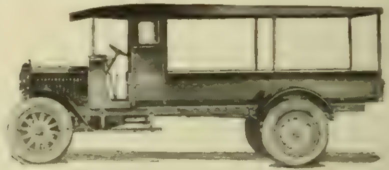


HAND BENDING MACHINE WITH CAPACITY FOR 1½-IN. ROUND BARS

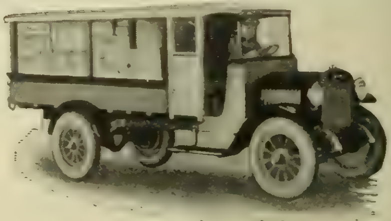
The large machine has a die 3 inches in diameter and is provided with an adjustable clamp corresponding to the thickness of the bar. The pinion is provided with a ratchet lever and engages the gear segment on the main frame. If bars are bent too much they can be counterbent without removal from the machine and without making adjustments in it. For bars one inch or more in diameter, two men are required to operate the machine. The catalog contains convenient tables showing the widths, areas, and perimenters of round and square bars of comercial sizes from ⅛ to 2 inches.

DUPLEX LIMITED

The Duplex Truck Company has just put out on the market a new two-wheel drive type of machine known as the Duplex Limited and designed around pneumatic tires, which has unusual speed intended to fill the gap between strictly light delivery cars and slow speed trucks. It will safely and economically handle loads up to 5,000 pounds including body weight at the highest legal speed.



HIGH SPEED TRUCK



LIGHT DELIVERY CAR

It has a four cylinder, 25-h.p. engine, centrifugal pump water circulation, Duplex radiator supported on frames giving it a possible movement of 1-4 inch in any direction without compact, storage battery ignition, and electric starting and lighting.

Speed is obtained through motor power and not by low gear ratio; hence the adoption of a motor of exceptional power rating for a truck of its capacity. Gear ratio on high is in keeping with the motor power and maximum speed.

Both emergency and service brakes are of the internal expanding type on rear wheel drums. These are well proportioned, of ample capacity, and easily adjusted.

PUBLIC WORKS.
CITY COUNTY STATE
A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"
Vol. 49 FLORAL PARK, AUGUST 28, 1920 No. 9

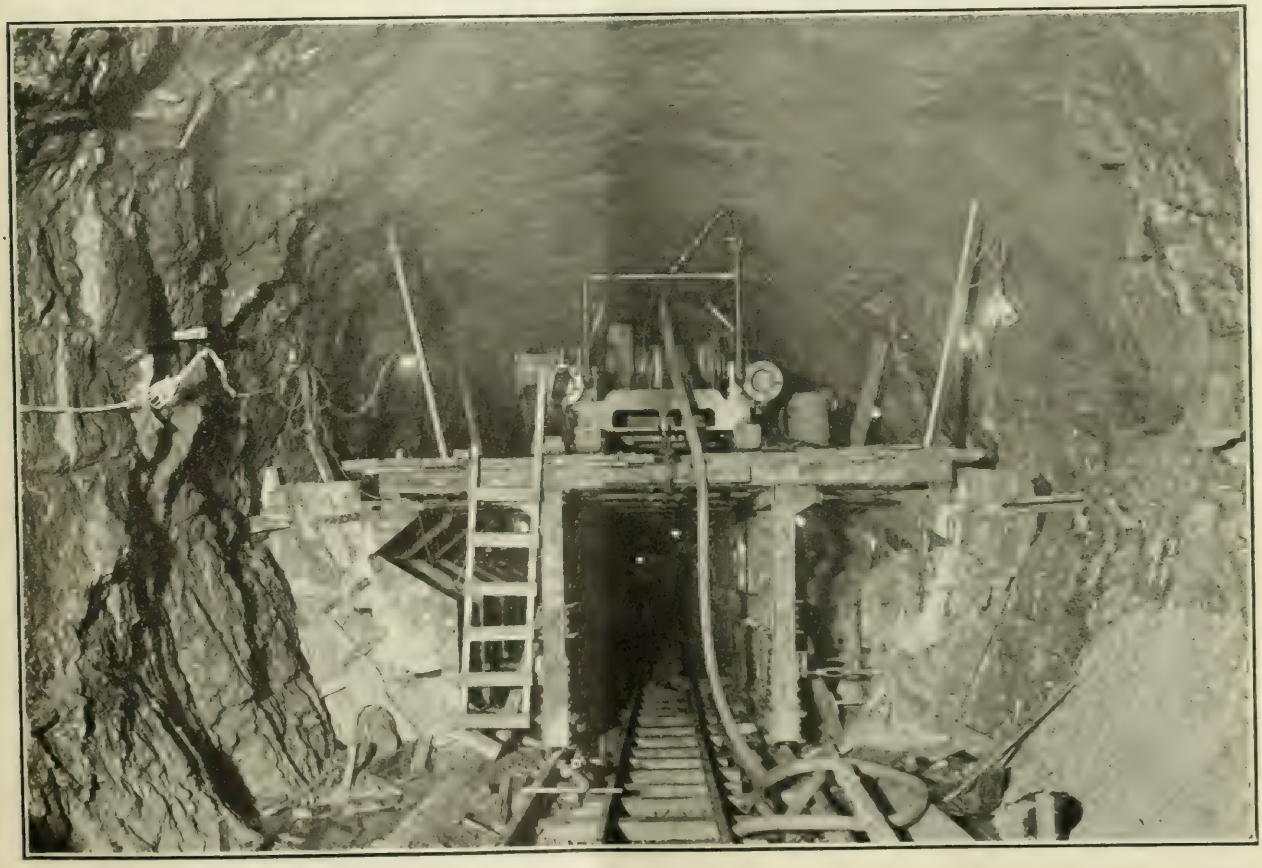
Lining Rock Tunnels in New York

Steel forms for roof arch and side walls. Concrete hauled in dump cars and pulled up inclined plane to platform at skewback level.

Several thousand feet of the land approaches to the three twin-tube tunnels under the East river that have recently been built for the New York Rapid Transit subway, were driven under atmospheric pressure through rock by the full width top heading and bench method, making an excavation about 18 feet square. This excavation was lined with concrete, having a finished interior radius of about 15 feet 6 inches for the arch, a flat invert, and offset sidewalls containing the duct banks, the same as the lining for the cast iron tubes.

CONCRETING INVERT AND SIDE WALLS

All of the concrete used for the lining was mixed in plants installed in the bottoms of the shafts as was the case for the cast iron tubes, and most of it was delivered to the forms in steel side-dump cars hauled by electric locomotives on narrow-gage tracks laid on the finished invert.



STEEL TRAVELER SUPPORTING SIDE WALL FORMS IN APPROACH TO SUBAQUEOUS SECTION OF TUNNEL. HOISTING ENGINE INSTALLED TO OPERATE INCLINED TRACK FOR CONCRETE CARS

The invert concrete was dumped from the cars directly to the bottom of the excavation, where it was placed without the use of forms, being dressed to the required surface by screed and straight edge.

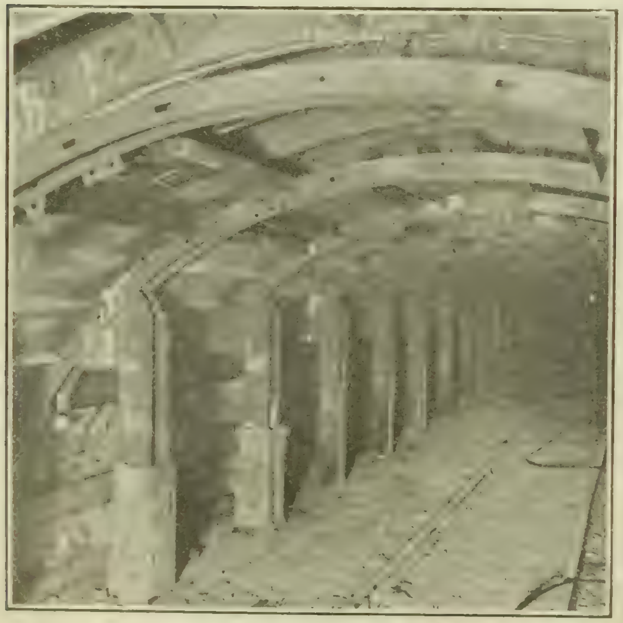
After the completion of the invert, a wide-gage track was laid on it concentric with the service track, and on this was installed a steel traveler with steel transverse bents placed 5 feet on centers and each consisting of a pair of vertical posts supporting a horizontal cap. The vertical posts were connected by longitudinal members at the top, bottom and center, and the caps were covered with planking forming a platform just above the axis of the tunnel and providing below it a clearance for the service track and for the transportation of plant and materials without interrupting concreting operations.

The traveler bents were assembled in sections long enough to make up about 100 feet and supported, from the overhanging end of the caps, steel ribs covered with wooden lagging which constituted the forms for the inner surfaces of the sidewalls, suitable to receive the duct banks which were subsequently built on them.

These forms were connected top and bottom to the traveler posts by turnbuckle struts that enabled them to be moved in or out horizontally, while the bolted connections to the end of the cantilever cross beams above could be removed, permitting the forms to be raised or lowered when stripping and transferring them. Wooden bulkheads, carefully scribed and set to fit the irregularities of the rock excavation, were bolted with steel scabs to the forms at the end of each section to retain the concrete in a vertical plane at the construction joint.

STANDARD ARCH FORMS

The arch concrete was placed by the means of standard all-steel forms identical with those used for the arch lining in the cast-iron tubes. The semi-circular form ribs were made with 6-inch channels, the webs horizontal and the flanges slotted to receive connection bolts through surface plates riveted to the steel lagging plates from about 15 to 48 inches long and 5 feet wide which were supported on the ribs.



STEEL ARCH FORM IN OLD SLIP—CLARK STREET TUNNEL

Each rib was made in three sections with bolted joints at the haunches, where gusset plates were provided and two vertical steel columns by which the forms were supported. Frequently the columns were enclosed with plank boxes to protect them from concrete and from impact and injury. The ribs were assembled 5 feet apart longitudinally to make sections about 100 feet long which were concreted in a single operation. The lagging plates were assembled successively from the skewbacks up as the concrete was placed in position, leaving an open space at the crown for placing the concrete. Some of these plates were provided with holes closed by tap bolts to allow for the subsequent grouting. The slotted holes in the ribs allowed for some adjustment to the irregularities of the work and facilitated making connections. The arches were struck by the operation of wedges under the supporting columns.

The accompanying view of the arch centers is from a photograph taken of their use in the cast-iron tubes, and the floor shown in that view is the concrete platform on top of the traveler cap just above the axis of the tunnel.

CONCRETING ARCH LINE

In the cast iron tubes and in most of the rock tunnel, after the sidewalls had been completed nearly up to the springing line, there was cast on them a skewback section reaching up a little above the axis of the tunnel to receive the arch concrete.

The concrete for the sidewalls and for the arch lining, excepting a small portion that was delivered by the pneumatic process near the bottoms of the shafts, was hauled up an inclined plane attached to the forward end of the form traveler, using a steel cable operated by a compressed air hoisting engine installed on top of the traveler, as shown in the accompanying picture. The concrete was then dumped on the platform and shoveled by hand into the wall forms and arch forms.

UNDERPINNING THE ARCH LINING

For a length of about 250 feet in both the north and the south tunnels of the 60th Street line in the approach under the Queensboro bridge, it was desirable to preserve the greatest possible width in the lower part of the rock tunnel so as to have clearance adjacent to the bulkhead at the end of the air pressure section. For this reason, the invert, sidewalls and duct banks were temporarily omitted in the early part of the operations, and were not built until after the arch lining had been completed.

After the excavation had been completed, the bottom was trimmed approximately level in the center, a service track was installed on it and vertical piers like pilasters were built against the face of the rock wall on each side and capped at the springing line by longitudinal concrete sections forming skewbacks for the arch. Subsequently the arch centers were set up between the pilasters, the lagging adjusted to bear against the skewback concrete and the concrete placed between the form and the top of the rock excavation, completing the arch, which was thus permanently supported on the pilasters while the full horizontal clearance of 15½ feet was left in the bottom of the tunnel for construction operations. The forms and travelers were removed and, when other portions of the work had been completed, the invert was made and the sidewalls were built permanently inclosing the pilasters and completing the tunnel lining.

This work was executed by T. McGovern & Company, as contractor. Some of the other rock tunnel work was done by Booth & Flynn, contractor. All of the steel forms and travelers were supplied by the Blaw-Knox Company. The work was designed and built under the direction of the Public Service Commission, D. L. Turner, chief engineer, and C. M. Holland and C. G. Drew successively engineers of tunnel construction.

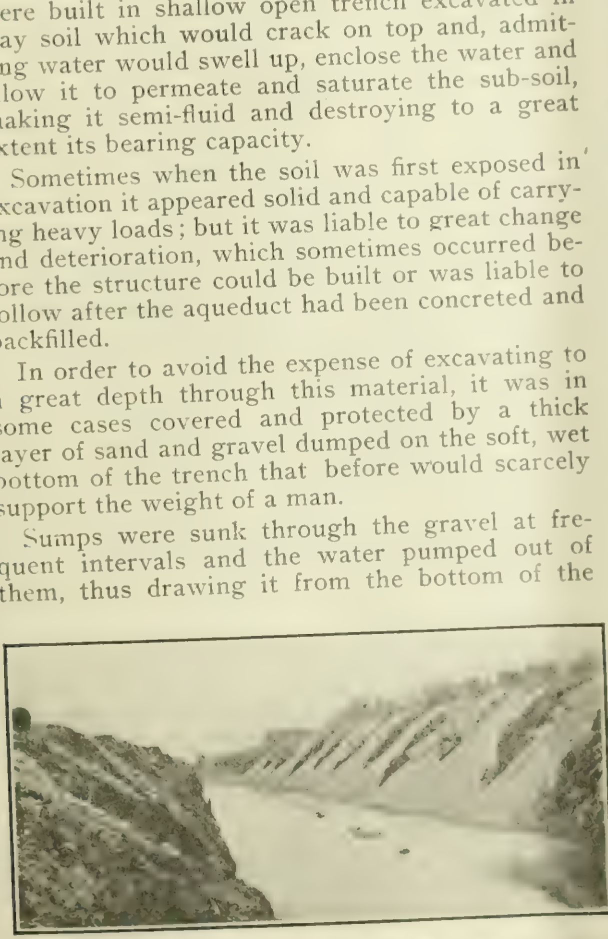
Improving a Soft Trench Foundation

Portions of the Winnipeg reinforced concrete aqueduct of 100,000,000 gallons per day capacity were built in shallow open trench excavated in clay soil which would crack on top and, admitting water would swell up, enclose the water and allow it to permeate and saturate the sub-soil, making it semi-fluid and destroying to a great extent its bearing capacity.

Sometimes when the soil was first exposed in excavation it appeared solid and capable of carrying heavy loads; but it was liable to great change and deterioration, which sometimes occurred before the structure could be built or was liable to follow after the aqueduct had been concreted and backfilled.

In order to avoid the expense of excavating to a great depth through this material, it was in some cases covered and protected by a thick layer of sand and gravel dumped on the soft, wet bottom of the trench that before would scarcely support the weight of a man.

Sumps were sunk through the gravel at frequent intervals and the water pumped out of them, thus drawing it from the bottom of the stratum rather than from the surface and automatically producing a very effective tamping of the gravel and solidification of the soft clay.


TRENCH WITH VERY SOFT BOTTOM COVERED WITH WATER-TAMPED SAND AND GRAVEL.

This was very successful, the sand and gravel becoming so dense that it required a pick-axe to remove it, and a splendid footing was secured on which to concrete the invert of the aqueduct.

The operation was much quicker and cheaper than digging through the soft material and provided a satisfactory foundation which did not settle under the load of the finished aqueduct and its contents. The work was designed and executed under the direction of James H. Fuertes, consulting engineer, New York.

Deepening Hell Gate

About forty years ago one of the most difficult blasting operations that had been conducted up to that time was successfully completed for removing "Flood Rock" in Hell Gate, located between New York harbor and Long Island sound. Until the removal of this rock it had been practically impossible for any but the smallest craft to pass by water between the harbor and Long Island sound. Since then smaller ocean-going coastwise craft had been able to pass through Hell Gate, but it is proposed ultimately to secure a passage for large ocean going steamers through this stretch of the East River.

At present, contractors are removing Frying Pan reef, which is 480 feet by 360 feet. The dredging company expects this work to extend over eight or ten months because of the short period of time each day when certain of the necessary operations can be performed. A drill boat is warped across the reef in paralell lines about 30 feet apart, drilling holes in each line. From 100 to 150 lbs. of dynamite is placed in each hole and, after they have been exploded, a dipper dredge loads the broken rock into scows. Except at slack water, the current at this point is so swift that it is only between tides that drilling points can be located, charges planted and fired, or the position of the plant changed, and such slack water generally lasts not more than 20 to a maximum of 23 minutes. Divers employed on this work are generally unable to spend more than 15 minutes under water at each slack-water period, or a total of 30 minutes a day. When this reef has been removed, Pot Rock and other less dangerous reefs will be attacked. It is expected that the completion of the channel will require 15 or 20 years and an expenditure of $55,000,000 to $75,000,000.

New York Permits Lime in Concrete

Use of hydrated lime in concrete has been permitted under certain restrictions for use on construction work in Greater New York, under a decision recently made by the Board of Standards and Appeals of that city. The matter came before this board on an appeal from a ruling on the use of hydrated lime in concrete work in the construction of a large building. After securing testimony from all available sources, the board reached the following decision:

"The use of hydrated lime in all classes of concrete construction shall not be prohibited when used in accordance with the conditions hereinafter set forth.

"The hydrated lime shall conform with the Standard Specifications of the American Society for Testing Materials.

"The maximum amount of hydrated lime which may be used shall conform with the following:

1-1½-3 mix; 4 lbs. of hydrated lime per 95 lb. bag of portland cement.
1-2-4 mix; 5 lbs. of hydrated lime per 95 lb. bag of portland cement.
1-2½-5 mix; 6 lbs. of hydrated lime per 95 lb. bag of portland cement.

"For hand-mixed concrete, the hydrated lime and portland cement shall be well mixed while dry.

"Hydrated lime shall not be used in concrete which is to be deposited under water."

Relation of Water Resources to Forestry[*]

By THORNDIKE SAVILLE [†]

The author sums up in this paper the accepted facts relative to flood control, erosion, evaporation, drainage of swamps, protection of water supplies and other branches of the subject, and explains the principal features of the recently enacted Waterpower Bill.

The relation of water resources to forestry is complex. The subject may be considered from three standpoints: first, the effect of forests upon the occurrence and distribution of water, or the hydrological relation; second, the effect of forests upon public health and scenery from their presence on municipal watersheds and reclaimed swamps, or the public welfare relation; and third, the effect of forests upon waterpower, navigation, agriculture, etc., or the economic relation. These three relations may be analyzed in accordance with the following outline:

I. *Hydrological*:
  (*a*) Flood control.
  (b) Regulation of run-off and its relation to evaporation and seepage.
  (c) Erosion and silting.
II. *Public Welfare*:
  (*a*) Protection of public water supplies.
  (*b*) Drainage of swamps and conversion to productive woodlands.
  (*c*) Provision for parks and recreation areas.
III. *Economic*:
  (*a*) Conservation of water and forest resources.
  (*b*) Erosion and silting; effect on nagivation and agriculture.
  (*c*) Employment of construction labor during winter months.
  (*d*) National forests and water resources.
  (*e*) State and municipal forests and water resources.

I. HYDROLOGICAL

(*a*) *Flood Control.* A considerable literature has grown up in the past ten years relating to the effect of forests upon the magnitude and frequency of floods. Eminent scientists and engineers have violently espoused each side of the controversy. Proponents of forestry measures have made startling claims for the favorable influence of forests in mitigating the evil effects of floods. Some engineers have made equally inclusive statements as to the entire absence of any beneficial effects of forests upon flood control. As a result, due to the emotional appeal of the forestry advocates, the general public has an exaggerated idea of the benefits of forests upon flood mitigation, and scientists are bewildered by the conflicting statistics of engineers.

Out of all of this mass of contradictory evidence a few general principles may be regarded as well established. In mountainous districts, where the streams are bordered by steeply sloping hills the forest cover serves to reduce both the frequency and magnitude of the average flood, and consequently is highly beneficial. After protracted rainfall, when the cover has become saturated, this effect is absent. Therefore, the maximum floods, even in mountainous regions, are little affected by the presence of forests. The relative beneficial effect of forest cover decreases with increase in size of the mountain stream. On very large rivers, or on rivers draining a rolling or flat country the presence of forests does not seem to affect the magnitude or frequency of floods.

(*b*) *Regulation of Run-off.* Like the preceding, this has long been a moot question, and, as above, the beneficial effect of a forest cover is most evident upon the run-off of streams draining a mountainous territory. The forest roots and humus undoubtedly retain much water from rain storms, and deliver some part of it later to the streams, thus conserving what might otherwise go to waste on flood flows. Moreover, the shading effected by trees serves to retard the melting of snow, and the evaporation from the land surface. On the other hand the evaporation from rain and snow on the leaves is great. The consumption of water plant growth is, however, less for trees than for any other kind of vegetation. Conifers are the best trees from nearly all stand-points of water conservation. As before, these conditions are most favorable for regulating stream flow in regions of steep gradient where the water from average rains seeps rapidly into and through the humus and is fairly quickly delivered to the stream. The discharge is thereby rendered more constant. In regions of flat gradient the presence of forest cover may be disadvantageous in that seepage is less rapidly removed, increasing the amount of water evaporated by vegetation or used in plant growth, and reducing the discharge of the streams.

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[*] Address before North Carolina Forestry Association, Asheville, N. C., June 10, 1920.

[†] Associate Professor of Hydraulic and Sanitary Engineering, University of North Carolina.

(*c*) *Erosion and Silting.* Removal of forests inevitably causes extensive gullying of the slopes, with consequent transportation of the eroded material to the streams. The result, from a hydrological standpoint, is two-fold. First, the regimen of the streams is distrubed. They must carry a load of detritus beyond the capacity attendant upon their normal gradient. This means deposition, building up of the stream bed, alteration of the course of the stream, and transportation of debris to points below, where navigation and flow in a larger stream may be adversely affected. Second, the detritus washed from the deforested land is transported by the streams and deposited in any reservoirs created for water supply, water-power, or irrigation purposes. Forestry enthusiasts have stressed the importance of forests in the regulation of flood flows and run-off. The effect of deforestation in causing erosion and silting is probably more important and of more far-reaching consequence. The beneficial effects of forests upon these is very considerable.

II. PUBLIC WELFARE

(*a*) *Protection of Public Water Supplies.* The protection of impounded public water supplies from all possible sources of pollution demands ordinarily a minimum use of the watershed for domestic or agricultural purposes. The best kind of watershed, from a hygienic standpoint, is one thickly wooded. Cities are rapidly coming to pursue a definite policy of forestation upon their watersheds used for domestic water supply. This policy is carried out from the double relation of health and economy. The economy aspects of the question are discussed later. Closely related to the forestation of watersheds is the protection of reservoirs from dust, and the effect of decreased evaporation due to adjoining woods.

(*b*) *Drainage of Swamps.* Within recent years the drainage of swamps as an anti-malaria measure has been carried out on a constantly increasing scale. The results may be three-fold: first, the elimination of malaria; second, the reclamation of valuable agricultural or building land; and third, the conversion of vast tracts of useless land into ground suitable for forestation.

(*c*) *Provisions for Parks and Recreation Areas.* The creation of parks and open spaces where people living in congested districts may get good fresh air and a chance for out-of-door recreation has become a well-established adjunct of any municipal or state public welfare program. There has been a pronounced tendency of late years on the part of cities to make beauty spots of their water supply areas. The reservoirs near the city are equipped with attractive buildings, and shade trees to serve as open spaces and recreational centers. The larger areas on the watershed are laid out with walks and drives, experts in landscape architecture and forestry are retained to formulate a policy, and the district is made attractive to automobilists and excursionists from the city. The thoughtful planning of the environs of municipal watersheds was begun by the Metropolitan Water Board in Boston under the direction of the late Frederick P. Stearns. Here miles upon miles of beautiful drives lead the automobilist about the secluded reservoirs and lakes; while the tramper, picknicker, or boy scout, finds countless paths leading through the wilder portions of the reservation. The whole project is under the guidance of an expert forester and landscape architect. This plan so successfully pursued in Boston has been followed by Hartford, Conn., New York, Asheville, N. C., and other cities, in the prosecution of extensive additions to their water supply areas. The drives and forests about the watersheds are annually attracting thousands of visitors.

III. ECONOMIC

(*a*) *Conservation of Water and Forest Resources.* The conservation of water resources is affected by the greatest economic use, and is two-fold. The waters not utilized, and which would otherwise be wasted, are set to productive use; and thereby (in the case of water-power) a corresponding saving is effected in nonrenewable energy sources such as coal or oil. With increased cost of fuel, and difficulty in transporting it to inland points, the development of water-power projects has been tremendously stimulated during the past few years.

At present the demand for electric power is far beyond the supply in many parts of the country. Public utility corporations have hesitated to enlarge their plants for two reasons: first, the difficulty in obtaining labor and materials and the high prices for these, and second, the reluctance of public service commissions to allow increase in rates to cover increased cost of new development. This attitude has made it difficult for corporations to obtain money for new improvements. Where water-power sites existed upon navigable streams the policy of the national government has not been such as to make private power developments practicable. This is now remedied by the recent enactment of the Water-power Bill, which will tremendously stimulate developments in some parts of the country, and the effects of which are discussed separately hereafter.

In some of the eastern states the larger water-powers have nearly all been developed. There still remains a vast amount of power in the smaller falls and streams, which individually may not be economically developed. It is now possible, through the utilization of the induction generator, to develop a number of such streams, interconnect them, and tie them into a larger controlling system. They will then feed into the system a variable amount of power, depending upon the season. The development of district water-power schemes of this sort, which in part at least may be automationcally controlled, is one of the most hopeful means of increasing electric power output in manufacturing regions. Several installations are already in operation. Newer developments will probably follow some such scheme as is outlined in the Super-power project for a great trunk line system from Boston to Washington, an investigation for which is provided in the last Sundry Civil Appropriation Bill.

Like water-power, the conservation of forest resources is affected by maximum judicious use. The principles of selective cutting and reforestation are too well known to need discussion here. Just as water-power has become finally recognized as a national asset needing Federal control, so should general regulations of state and nation control the promiscuous destruction of our forests.

A double conservation is possible here also, through electrification of the steam railways. Thousands of acres of valuable forest land are annually destroyed through fire caused by sparks from locomotives. The electrification of the railways in forest regions thus not only effects economy in fuel conservation and operating expenses, but also in preventing the waste incident to forest fires.

(*b*) *Erosion and Silting.* The hydrological effect of erosion and silting caused by deforestation has already been discussed. Next to the destruction of the timber itself probably the gravest economic loss arising from removal of the forests is in the silting of navigable streams and the destruction of valuable bottom lands. Instances are not uncommon where navigable streams which a score of years ago required little maintenance of channel, now need constant dredging to remove the deposits brought by floods from the denuded mountain sides. This effect is felt far distant from the source of the trouble, and the material eroded from mountains by torrential streams may eventually cause deposits on a large navigable stream hundreds of miles away. Once the damage is done, reforestation and flood control works are the only palliatives of the cause. Both have beeen extensively practiced by the French in the Alps, at great expense. A sound forest policy will eliminate the necessity for such regulatory works.

Some of the most valuable and productive land in upland regions lies in the valleys of the streams. As deforestation proceeds, with consequent erosion, the stream sides are aggraded by the transported detritus. In consequence, at times of flood the water overflows the banks, causing washouts, gullying and destroying the fertile valley bottoms. The remedies and preventives are the same as those described in the preceding paragraph.

(*c*) *Employment of Construction Labor in Winter.* The beneficial effects of forests upon watersheds used for domestic water supply has been mentioned previously. An important corrollary of this is the opportunity which municipal or state forests give for the employment of construction labor during the winter months. The present scarcity of skilled labor makes it imperative that laborers experienced in water works, sewer or road construction be retained throughout the year. If they can be utilized in forestry work on the watersheds during the winter months, they will not be a dead load on the pay roll. The cities of Hartford and New Haven, Connecticut; Boston, Massachusetts; and Nashua, N. H., have practiced this combination of forestry and labor conservation with great success. Even if value of the wood cut will not show a profit, a careful policy will make expenses meet, and serve to hold skilled labor. After a decade or more of such procedure, there may be some actual profit from the forestry operations, as the labor becomes more skilled in lumbering and the value of the timber available for cutting increases.

(*d*) *National Forests and Water Resources.* Since 1901 the Secretary of Agriculture has been empowered to issue permits for "the occupancy and use of National Forest lands for the construction, maintenance and operation therein of project works for the development, transmission and use of power." The policy of the Department has always been to encourage the development of water-power projects on national forests, but in spite of the fact that many excellent sites exist, relatively few projects have been undertaken. This has been due largely to the provisions of the act which allows the Secretary to revoke a contract at will; to impose new rental rates after a lapse of ten years; to treat appreciation of land as income for rate making; and to other broad powers of the Federal government. Such regulations have made investments by private capital unattractive.

The Water-power Bill (H. R. 3134) which has just become law makes definite provision for the development of sites on the national forests, and eliminates many of the disadvantages enumerated above. A Federal Power Commission, consisting of the Secretaries of War, Interior and Agriculture is appointed, which has very broad powers regarding all use of the waters subject to regulation by the United States. Licenses will be issued for a period of fifty years, and are revocable only after civil procedure in the federal courts. The passage of this bill will undoubtedly stimulate greatly the development of water-power projects on the public domain.

(*e*) *State and Municipal Forestry and Water Resources.* Where power shortage exists, and power companies are unwilling or unable to extend their plants, the question of municipal and state enterprises become important. Adequate power is so essential to the development of any territory that a municipality or state can afford to expend large sums in water-power developments with a much less return on the investment than a private company, since the difference is the intangible return from the possession of power which attracts industry to the city or state. The development having been made, the operation of it to supply power is most economically made by long term lease to a public utility company.

The enactment of the National Water-power Bill is of vital concern to all states, since the powers of the national government under the terms of this bill are so sweeping as to seriously affect state control of its water-power resources unless certain provisions are made. It especially behooves states or municipalities containing national forests or the headwaters of navigable streams within their boundaries to act quickly to preserve to themselves the administration and control of water-powers situated therein. The Power Commission is authorized to issue licenses for and administer the operation of water-power developments on the "navigable waters of the United States, or upon any part of the public lands and reservations" (including national forests), and to direct the "construction, maintenance and operation of headwaters or other improvements of streams upon which the Commission is authorized to issue licenses." This means that a farmer desiring to erect a 150-horsepower mill on a small stream tributary to a navigable river must have a federal permit, or have his project modified and perhaps controlled by federal regulations.

The act further provides that applicants for federal licenses must have "complied with the requirements of the laws of the state or states within which the proposed project is to be located with respect to bed and banks and to the appropriation, diversion, and use of water for power purposes and with respect to the right to engage in the business of developing, transmitting and distributing power" . . . and that nothing within the act "shall be construed as affecting or intending to affect or in any way to interfere with the laws of the respective states relating to the control, appropriation, use, or distribution of water used in irrigation or for municipal or other uses, or any vested right contained therein." For states not provided with laws relating to water use or water-power the act provides "that in case of the development, transmission, or distribution, or use in public service of power by any licensee hereunder or by its customer engaged in public service within a state which has not authorized or empowered a commission or other agency or agencies within said state to regulate and control the services to be rendered by such licensee or by its customer engaged in public service, or the rates and charges of payment therefor . . . jurisdiction is hereby conferred upon the Commission. . . . to exercise such regulation and control until such time as the state shall have provided a commission or authority for such regulation and control." Moreover, the bill specifically provides especially favorable terms for state or municipal developments in the national forests.

Excellent as the provisions of the Act are in furthering water-power development in the United States, it is evident that such states as do not have conservation commissions, a geological survey, or other agency authorized to investigate and regulate the use of the water-power in that state are likely to be at great disadvantage. Certain states have near their boundaries great water resources. If these are developed by extra-state corporations and the power transmitted to the adjoining state for industrial use, the owner state loses the utilization of a valuable natural resource. If a city is situated near a national forest, a private manufacturer may use the water resources of the forest under Federal license, and the municipality, desiring to extend its power facilities or water supply may have to go a great distance and be at great expense to provide what it should have available near at hand. It is evident that the provisions of the Water-power Bill are eminently fair and favorable to states and municipalities, but they must be provided with the administrative machinery to preserve and utilize their water resources. Several states, not so provided with water use laws, or commissions for their enforcement, have recently been stimulated to provide them by the passage of the Water-power Act. Those states or municipalities having water resources of magnitude will do well to immediately investigate their potentialities, enact laws regarding their use, and provide a commission to investigate and regulate the development of power projects, whether or not these come under the provisions of the Water-power Bill.

Report on Milwaukee's Water Supply*

Rapid sand filters recommended, of 160 million gallons capacity and with special coagulant-mixing devices, and chlorine treatment, estimated to cost $4,580,000.

RECOMMENDATIONS

"As a result of the study of the detailed data set forth in this report, and from a knowledge of local conditions obtained from personal observation for a period of more than a year, certain conclusions have been reached which have been embodied in the following recommendations:

"1. That, in view of the present polluted condition of the city's water supply and the probable continuance of dangerous contamination, even if the best methods now known are used to dispose of the sewage of the city, there be constructed a filtration plant of the rapid sand type, and that the project be gotten under way immediately.

"2. That this filtration plant be located on the lake front near the shore shaft of the Linwood avenue intake tunnel.

"3. That on account of the increasing consumption of water by the rapid growth of the city, the filter plant be constructed to have a capacity of not less than 160 million gallons per day, based upon the usual rate of filtration for this type of plant, and that it be so designed that extensions of the plant may be made in the future.

"4. That in designing the filter plant, advantage be taken of certain information gained in the experimental work, namely, that adequate mixing of coagulating chemical solutions with the water may be obtained in comparatively simple devices of much less cost than those now commonly employed; that a period of sedimentation after coagulation be provided of not less than three nor more than four hours, based upon theoretical displacement; that a filter sand be used, having an effective size of not less than 0.35 m.m., nor more than 0.40 m.m.; and that conduits and pipe lines be provided of such size that rates of filtration from 15 to 20 per cent in excess of the nominal rate may be utilized.

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*Continued from page 170

"5. That disinfection of the water after being filtered be practiced as a second line of defense against contamination; that chlorine be used for this purpose, and that the amount applied be approximately one-half that which was used on an average in treating the raw water supply of the city during 1919.

"6. That no attempt be made at the present time to employ ozone as a disinfecting agent for either the raw or filtered water, since the experimental evidence obtained indicated the apparatus had not been developed sufficiently to produce ozone at low enough cost to enable it to compete with chlorine as a disinfecting agent; and that the first cost of installation and the subsequent cost of operation and maintenance would be too high for use in a large municipal plant of the size required by Milwaukee.

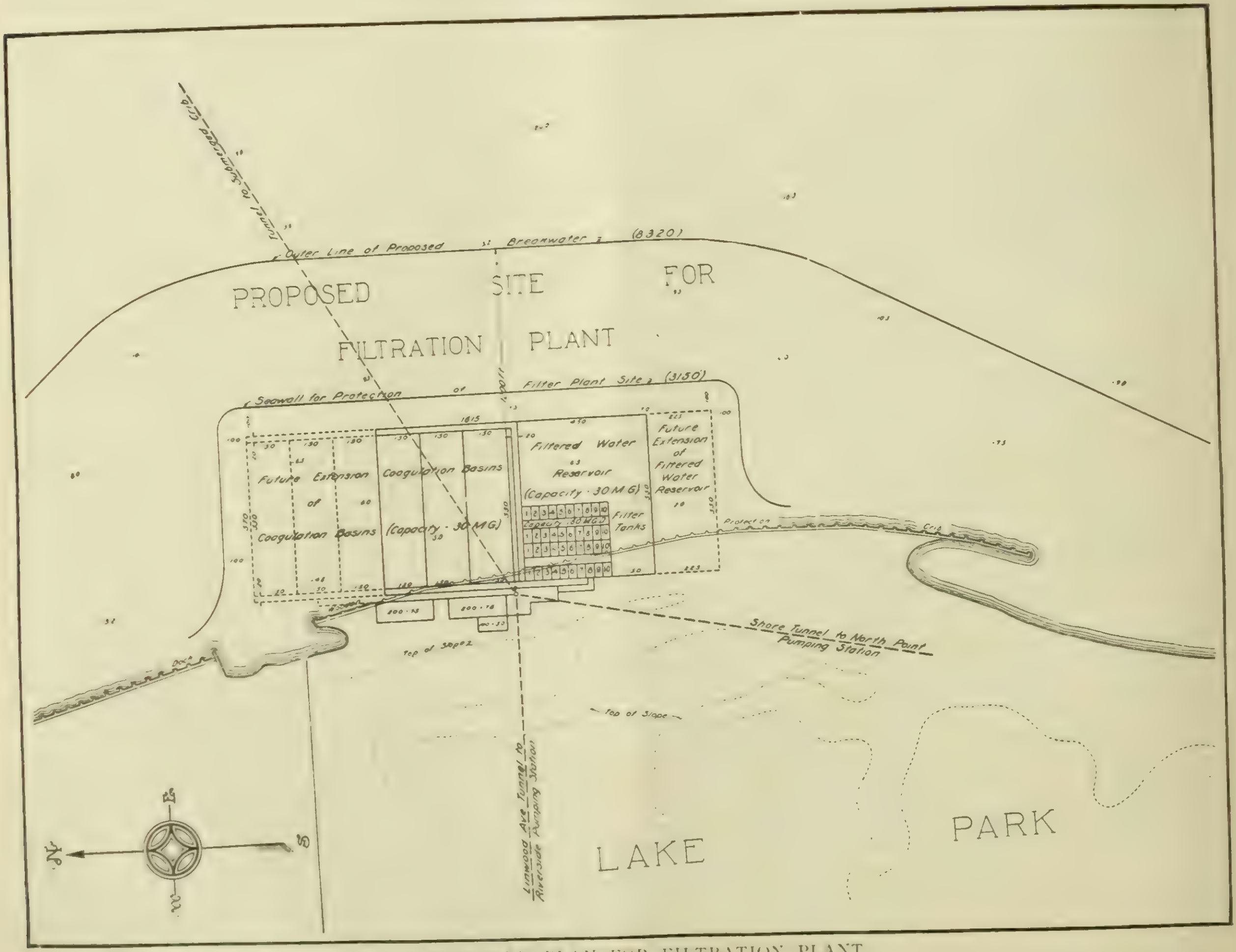
ESTIMATED COSTS

Owing to present conditions as to prices of materials and labor, it would not seem practicable to make any very reliable estimate as to the cost of a plant which, if begun at once, would not be completed for several years; and yet it was necessary to form some idea of what the cost would be. In making this estimate Mr. Ellms based his figures on plants of similar size to the proposed plant, and present prices.

The site which seemed most suitable of those available for the plant was on the lake front near the present intake tunnel, the shore tunnel which conveys water to the North Point pumping station, and a new tunnel now under construction. He selected the junction of the intake tunnel running west to the new pumping station. But there is little room on land for building a filter plant at this point and land will have to be made into the lake at an estimated cost, including protection wall, of $382,700. He believes, however, that a plant at this point would become an object of great interest to the public, and would add materially to the beauty of the contemplated improvements along the shore of the lake.

In addition to the cost of the protection wall and filling of the site, the estimated cost includes $867,440 for foundations, including excavation, coffer dam and piles; $782,000 for coagulation basins, mixing flume and discharge conduits; $1,500,000 for filter tanks, piping, valves, gates, filter equipment and filtered water reservoir; $448,000 for chemical house, wash-water tank, and low-service pumping station; to which is added 15 per cent, or $600,000, for contingencies and engineering, giving a total of $4,580,140.

The cost of operation includes that of lifting the water from the intake shaft to the mixing flume. From this point it will flow by gravity to the filtered water basin and thence through


Tunnel to Linwood Ave. Crib
Outer Line of Proposed Breakwater (8320)
PROPOSED SITE FOR FILTRATION PLANT
Seawall for Protection of Filter Plant Site (3150)
Future Extension of Coagulation Basins
Coagulation Basins (Capacity 30 M.G.)
Filtered Water Reservoir (Capacity 30 M.G.)
Filter Tanks
Future Extension of Filtered Water Reservoir
Shore Tunnel to North Point Pumping Station
Top of Slope
Linwood Ave. Tunnel to Riverside Pumping Station
LAKE
PARK
N
S

PROPOSED PLAN FOR FILTRATION PLANT

tunnels to the pumping stations. The cost of this pumping should be included as part of the cost of purification. There would be a total lift of 35 feet, and the cost would be approximately $1.80 per million gallons if done with electric motors driving centrifugal pumps, or 70 cents per million gallons if the pumps are driven by steam turbines; these costs being based upon a combined efficiency of pumps and motor of 75 per cent of the water horse power, and electric current at $1.25 per k.w.h.; and steam at a cost of 35 cents per thousand pounds, with 13.6 pounds per horsepower-hour. These figures are for power only. Purification is estimated to cost about $4 per million gallons, of which the cost of the chemicals will be about 40 to 45 per cent, the balance being for labor and materials for operation and maintenance. Disinfection with chlorine is included in the chemicals but would cost only about 15 to 20 cents per million gallons. As for ozone disinfecting, it was estimated that, with electricity at 1 cent per k.w.h., the production of the ozone alone would cost over $4 a million gallons, while that of compressing and applying it would probably exceed this, and in addition there would be a loss of head by water in passing through the ozone towers. It appearing that the cost of disinfecting by ozone would be approximately 50 times as great as by chlorine, no attempt at accurate estimating was made.

Summing up, assuming a plant of 160,000,000 gallons daily capacity and a cost of $4,500,000, the operation and maintenance charges would be from $5 to $6 per million gallons, and the fixed charges about the same, or a total of $10 to $12 per million gallons. This would amount to only 1 to 1.2 cents per thousand gallons, which is certainly a small amount to pay for insurance against water borne diseases as well as for providing a clear and brilliant water of the most acceptable character.

Changes in Garbage Disposal Proposed at Portland

Municipal collection of garbage, or at least a complete change from the present method of garbage disposal in Portland, Oregon, seems inevitable. The city council on July 30 authorized a call for bids for the privilege of either collecting or disposing of Portland garbage. With such bids before the council by September 10, it is hoped that some proposal may be submitted to the voters at the November election.

City commissioner Bigelow has investigated various proposals made by reduction plants and garbage collection agencies and said he was satisfied that some plans suggested would be more satisfactory to the city, both from a financial and a health viewpoint, than the system now in operation.

It is the plan of commissioner Bigelow, approved by the council, to obtain bids from firms and individuals prepared to tackle the Portland garbage problem. Bids will be called for through advertisements intended to reach all persons interested in the subject.

Such bids must be submitted to the council by September 10, after which time the council will make a careful investigation of the various proposals and select the most suitable for submission to the voters.

The Los Angeles plan is looked upon with considerable favor.

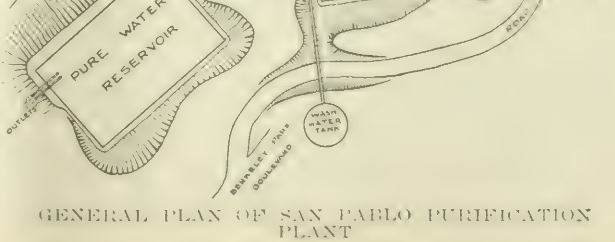
Under the present system of garbage collection in Portland it is estimated that not more than one-third of all the garbage is collected and destroyed at the incinerator. The collection is in the hands of private collectors who charge a monthly fee for their services. The charge results in many people in the city refusing to utilize the present system. Garbage disposal by individuals, in many cases, is said to be a menace to public health.

At least a dozen firms operating throughout the United States are expected to bid for the privilege of collecting garbage in Portland, or paying for the garbage the city will collect in the event the voters indorse the plan.

Building San Pablo Filters

Best equipped and most modern filter in California, built on steeply sloping land. Also the highest hydraulic-filled dam in the country.

The water supply for Alameda, Oakland, Berkeley and a number of smaller California municipalities on the east side of San Francisco Bay is provided by the East Bay Water Company, the total amount supplied being in the vicinity of 20 million gallons daily. This is nearly the maximum capacity of the water sheds and reservoirs controlled by the company, and about four years ago it began the construction of what is known as the San Pablo project, which will give it an added average capacity of 12 million



GENERAL PLAN OF SAN PABLO PURIFICATION PLANT gallons a day, with a peak capacity 50 per cent greater. The cost is estimated to be about $3,500,000. The following description of the construction work on this project, and especially of the filter bed, is condensed from an article in The Excavating Engineer.

The project comprises a dam in the San Pablo canyon, a water shed lying east of the Berkeley hills, an outlet tunnel through these hills, and a filtration plant on the west slope of the hills.

The dam is of earth, hydraulic-filled, with a crest 1350 feet long and 55 feet wide. It has been carried 140 feet above the creek bed and forms a reservoir with a capacity of 7,250 million gallons. It is proposed ultimately to carry it 40 feet higher, when its capacity will be 14,000 million gallons and the water will be backed up the canyon for 5½ miles When completed, it will probably be the highest hydraulic-filled dam in the country, with a base from toe to toe of approximately 1400 feet, and contain 2,100,000 cubic yards of material. Work has been temporarily suspended on the dam at the height of 140 feet, but it is expected that it will be resumed in the fall.

The water from this reservoir is brought to the distribution system of the company by a tunnel 13,563 feet long through the Berkeley hills, passing 1,000 feet below their crest The tunnel is 5 feet 6 inches by 6 feet 6 inches, horse-shoe shaped, and lined with concrete with an everage thickness of 8 inches. It has a slope of 1 in 1,000. This tunnel passes under Wildcat Canyon and here a shaft 305 feet deep brings the water from the creek bed down to the tunnel beneath. The dam and tunnel are being built by Bates & Borland of Oakland as contractors.

FILTRATION PLANT

At the western end of this tunnel the water is discharged into a filtration plant which is said to be the best equipped and most modern of its kind in California. From the tunnel the water enters a 42-inch steel pipe line which discharges through a net work of pipes into an aerator basin 80 feet square. Adjacent to this basin is a double coagulation basin 300 feet long by 170 feet wide, divided into two basins by a middle partition wall. The water passes through a Venturi meter in going from the aerator to the coagulation basin.

After receiving the coagulant, the water passes through the headhouse to the filter beds, of which there are eight arranged in a double row of four each. The net area of each bed is 532 square feet. A wash-water tank is placed on the hill above the plant, giving pressure for washing the filters. Another small reservoir still further up the hill furnishes water at a higher constant pressure for operating the hydraulic valves and other auxiliaries. The plant is so laid out that space is left for eight more filter beds when these are needed.

From the filters the clear water pases to a pure-water reservoir having a capacity of 6 million gallons, from which reservoir it passes directly into the distribution system. The reservoir is 351 feet by 169 feet, with a concrete roof which will be covered with 3 feet of soil and sod.

All the water used in washing the filters will be carried to small basins, where the solid matter will be allowed to settle out and the water be pumped back to be filted again, no water, therefore, being wasted.

Excavating for the filtration plant was begun in July, 1919, and on January 7, 1920, excavation work was finished. The excavating was done by means of an 18B Bucyrus revolving shovel on caterpillars. The ground had a slope averaging 17 degrees and in some places reaching 45 degrees, and all of the basins were made in cut and fill, the excavated material being used for the embankments on the lower sides, the most impervious materials being placed so that they would come next to the concrete work. Fresno scrapers were used for levelling the embankment and also on side-hill work to form benches for the fills. The material excavated was about 30 per cent sandstone and the rest a conglomeration of disintegrated sandstone, shale, and igneous rock. Blasting was used for about 75 per cent of the material. The maximum depth of excavation was 51 feet. All of the excavation was done by the shovel named, except that for about three weeks a Thew ⅝-yard revolving shovel was used in addition.

The clear water basin required 43,000 cubic yards of excavation, the coagulation basin 24,000 yards, the filters 15,000 yards, the aerator 1,000 yards, and the wash water basin 1,500 yards; a total of 84,500 cubic yards. This material was hauled an average distance of about 400 feet by 2-yard Troy wagons.

From 8 to 13 wagons were used, the average being 11, and they were so well organized that the shovel never had to wait for a wagon but worked steadily, with practically no breaks in the schedule of making a complete cycle in 20 seconds. Three horses were used on most of the wagons, although an occasional snatch team was used for hauling and fuel.

All suitable material was used in making the embankments, and the successive layers were rolled by means of a 10-ton Austin steam macadam roller, the slopes of the embankments being finished by hand.

The steam shovel averaged about 500 yards a day of eight hours, the highest record being an average of 600 yards a day for a period of 23 days. All the work was carried on with one operator, one fireman and one general untility man.

The filtration plant will cost about $500,000 and was designed by Hazen, Whipple & Fuller of New York. The resident engineer in immediate charge of the work was George W. Hawley.

Highway Engineering Scholarship

J. G. Culbertson, manufacturer of automobile trucks, has established at the University of Texas, a scholarship with an annual income of $300, to be awarded every year to a student specializing in highway engineering.

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Soft Spots in Road Subgrades

A theory, or possibly it might better be called a suggestion, as to the cause of the formation of soft spots in subgrades under roads, especially in clayey soil, was given to the writer by James H. Sturdevant, division engineer of the New York State Highways, while discussing the breaks which occurred in the highways of his division this spring and which were described in our issue of August 14. It will be recalled that the numerous breaks in this instance were caused by a combination of an unusually long, wet spring accompanied by the travel over the road of a very great number of very heavy trucks.

It is Mr. Sturdevant's idea, as we understood it, that, had the number of trucks been very much less, perhaps only those which used the roads under previous conditions, even though the individual weights had been as heavy, these breaks would not have occurred. He cited as an illustration of his idea that, if wet clay be struck with a tamper or a hammer, moisture would appear at the surface but in a few seconds would be reabsorbed by the clay. If, however, continuous repeated blows be delivered at a single point, the moisture from considerable depth would be forced to the surface, and this would become more saturated and finally of jelly-like consistency. The same phenomenon might be considered as occurring in the clay beneath a pavement when this receives, from heavy truck wheels, repeated blows in more or less rapid succession, such blows being sufficiently heavy to be transmitted through the foundation to the clay beneath. The effect would be to bring moisture to the surface and, where the conditions were such as to concentrate at one point a sufficient amount of moisture, this would finally produce a clay so soft as to no longer have sufficient stability to support the load, even though distributed over considerable area by a macadam base 15 inches thick, or by a concrete base 6 inches thick.

The idea is an interesting one. Whether or not it is wholly or partially correct, the solution would seem to be the same—to prevent the presence in the subgrade, at any point within several vertical feet of the under side of the pavement, of any more moisture than the soil will retain by mere capillary attraction. Anything which causes water to collect at a given point, such as pot holes or depressions in an impervious substratum which has been filled in with sand or gravel, or similar depressions in a rock cut made in grading same, is to be avoided and the possibility of water collecting there eliminated. In the case of rock, probably the holes should be filled in with a lean concrete, and in the case of clay, by impervious material of the same nature as the rest of the stratum, the filling material in each case being brought up to a uniform grade with the rest of the surface. This at least will permit the water to distribute itself and possibly to drain away, where otherwise it would be held in these pot holes until it either produced a soft spot in the manner above suggested, or was gradually carried to the surface by capillary attraction and evaporated.

Our National Water Resources

At first thought the average citizen might not appreciate the importance to him of the conservation of the forests and wooded hills of the country, but engineers who have to deal with water supply and power plants should certainly do so. In an article in this issue Professor Saville sums up a great many of the ways in which municipalities are affected, these including the water supplies which are distributed through the city mains, the current which is used for lighting and power, the floods coming down from the upper waters of streams to do in some cases enormous damage to the cities along their banks, the use of the woods and forests as recreation areas, and other minor features.

In the early days of the country, when practically all of it except the prairie regions and deserts was covered with forest, the trees were looked upon by the settlers chiefly as something to be gotten rid of in preparing the land for cultivation. Even now a great many think of wooded land as waste land, which the proper utilization of our resources will ultimately clear off for the development of farms. To a certain extent it is true that the country at large would benefit more by farms than by forests; but a time is reached in each section of the country when the land most suitable for farming has been devoted to this purpose and the remainder might better be left to the trees which grow upon it, or such growth be encouraged as the most economical use of such land, considering all phases of the public welfare.

The reduction of our forests to the point where timber becomes more expensive than brick or stone for building houses (as is now the case in some European countries), and where stream flow is more irregular and floods more frequent, thus reducing the value of water power and increasing the damage from floods, are only two of the possibilities of neglect of this subject which should suffice to impress its importance upon people generally.

All of these things should be appreciated to the full by engineers engaged in connection with public works and public service, and they should be among the foremost proponents of the conservation of our forests.

Sewage Treatment in English and American Camps

The description in this issue of the experience of English engineers in sewering the English aerodrome camps bears a striking similarity to the accounts by American engineers of their experiences in United States camps during the war, although there are several points of difference. In each case it was found that the amount of sewage to be provided for was underestimated and that special efforts were necessary to keep the water consumption and resulting sewage within the desired limits. In the matter of grease, however, the experiences differed, in that the English engineers report that no trouble was experienced from the grease in sewage, while the American engineers experienced considerable difficulty with grease; both finding that the grease traps employed were of little benefit. No figures were given in the article as to the amount of grease found in the English sewage, and it is very possible that the different kind and amount of food supplied to the English soldiers as compared to the generous supply of meats and other fatty foods supplied to the American camps is the explanation of this difference..

The treatment in the English camps appears to have been more thorough than in most of the American camps, and the explanation is probably the same as that of the earlier and more general attention paid to sewage treatment in England than in this country, namely, that streams into which the effluents could be discharged were much smaller there than here, or in some cases were altogether lacking.

On the whole, there would appear to be little for American engineers to learn from the experiences in the English camps, but they will be interested at least in learning of the similarity of conditions and of the methods adopted for meeting them.

Red Bank's Water Works

In the Advance Contract News columns of the August 7 issue of Public Works appeared an item stating that engineers engaged by the town of Red Bank, N. J., had advised that the town's mains be connected with those of the Tintern Water Company. We have received further information concerning this from the engineers engaged by the town, Tribus & Massa of New York City. They state that at the time of writing, their report upon Red Bank's water situation had not been presented as yet, but that they had advised, as an immediate safeguard for fire protection, connecting with a large main of the Tintern Manor Water Company, though with no recommendation for taking water therefrom as a regular source of supply but simply in time of emergency.

St. Paul's Water Supply

St. Paul, Minnesota, derives its water supply from two systems of lakes, with an additional supply from wells when necessary. The lake systems extend twenty miles north of the city, the various lakes being connected by conduits and canals. Tests of the water are made regularly and chlorine is administered whenever the bacterial count indicates this to be desirable, and from time to time the city has been officially assured that its water supply is safe; now, however, the State Board of Health, having made a survey of the water system and situation, has advised the city to install a filtration plant. Whether it does so now or not, it is evident that it must do so eventually, since the supply from the lakes is little more than sufficient for the present consumption and it is probable that the additional supply must be drawn from the Mississippi river above Minneapolis. The most immediate threat to the purity of the supply, however, is the fact that the village of Forest Lake is building a sewer system which it is said will discharge into the drainage area of the lake supply. The advice mentioned was communicated by the State Board of Health quite recently and no action has yet been taken upon it so far as we are informed.

A Comprehensive Power Scheme for 15,000,000 Population

With a view to utilizing to the fullest extent the water power along the Atlantic Seaboard between Boston and Washington for the production of hydro-electric power, the U. S. Geological Survey is conducting an investigation for which congress has appropriated $125,000 and which it is expected will be completed in about eighteen months.

The director of the survey, George Otis Smith, stated that the chief objective of the survey is to investigate the possibilities of economy that might result from the establishment in the Boston-Washington industrial district of a general system for the generation and distribution of electrical power. Consideration will be had not only of the present demands of the area, but also of the future ones, including possible electrification of the railroads and more complete electrification of industries. It is estimated that at present only 10 per cent of the power used in the eastern seaboard district is developed by water power.

It is probable that the plans proposed will consist of a main artery which would be fed from generating plants along the route (including those already in use in the various cities), while feeders from the main artery will distribute the power wherever needed in the district. Existing plants would probably sell, for distribution by the main artery, the surplus power not needed in their own vicinity, and additional water power and steam generating plants would be established, their location being chosen with reference to source of power rather than point of demand.

Sewage Treatment at English Aerodromes

Bases of calculation and kinds of treatment given; ventilation, pumping, grease removal, and other details.

The following description of certain features of the methods employed in England for sewering the naval and military aerodromes during the war and treating the sewage is abstracted from a paper by D. Balfour which was read before the Association of Managers of Sewage Disposal Works at Cheltenham, England.

In each of the aerodromes the calculation of sewage volume was based on a flow of 25 gallons per head per day, which experience showed to be none too large; in fact, in most cases it exceeded this although the consumption was considerably cut down when steps were taken to prevent the waste of water at taps, flush tanks, etc. (This parallels the experience at aerodromes in this country).

In calculating the size of sewers, allowance was made for a quarter of the daily sewage flow discharging in one hour, or at a maximum rate of six times the average flow; but in practice it was found that the maximum hourly flow was one fifth the total, occurring usually between 8 and 10 A. M. Practically no surface water was received and there were no trade wastes. In the majority of aerodromes the population provided for varied from 400 to 2,000. But for repair depots provision was for 2,000 to 5,000, and for training schools up to 10,000.

Earthenware pipes were used for sewers. Where there was no automatic flushing, the minimum grade allowed was 1 in 100 for 6-inch pipe and 1 in 70 for 4-inch pipe; but in a number of cases where pumping would have to be resorted to unless flatter grades were used, the alternative was adopted and these were flushd by automatic tanks fed with water from the water mains.

"Ventilation was provided by means of 4-inch cast iron pipes at the heads of the sewers carried up the gables or above the eaves of buildings, and no intercepting traps were used on the sewers or drains owing to the liability to cause stoppages." (English practice does not yet generally countenance the omitting of intercepting traps for the purpose of ventilating sewers, as is more or less common in this country). "Grease traps were provided for the kitchens or cook houses, which might have been dispensed with as their cleansing was generally neglected, so that the grease was discharged into the sewers, but no trouble was experienced with the same." (Grease gave a great deal of trouble in the United States camps, as we described several months ago.)

The land chosen for aerodromes was the flattest obtainable, and this made it impossible in several cases to carry the sewers to an outlet without pumping. For this purpose centrifugal pumps were used driven by electric motors and provided with storage tank; the motors being automatically controlled by a switch operated by a float in the storage tank.

In some cases, however, ejectors using compressed air and having a capacity of from 70 to 300 gallons were employed. In most cases electricity was not available between 11 P. M. and 7 A. M., although it was during the remainder of the day, and an air receiver of 200 to 400 cubic feet capacity was placed outside the compressor house, which held air under 100 pounds per square inch, which pressure was reduced by a reducing valve to that actually required.

In some cases the sewage was discharged into the sewers of nearby cities. In a few cases the aerodromes were situated on the sea coast or a tidal river, and the sewage was discharged into a storage tank with about three-quarters of a day's capacity and the contents discharged on the ebb tide.

In the majority of cases, however, the sewage was treated. Effort was made to make the treatment works as automatic in their action and as fool proof as possible, requiring the minimum amount of attention. Previous experience had shown that disposal by irrigation was unsatisfactory, and in addition all land was being used intensively for food production. In the majority of cases the purification plant consisted of sedimentation tanks, percolating filters and humus tanks.

"The sewage, on reaching the disposal works, was discharged into a screening chamber, where large solid matter was intercepted by an iron screen fixed at an angle, the bottom being in a curved sump 12 inches below the invert of sewer to prevent blockage of screen and backwatering of the sewer. The intercepted matter was daily raked onto a wooden platform and conveyed by a barrow and dug into the land.

"The sewage then passed into rectangular concrete sedimentation tanks which in every case were in duplicate, so that there was always one tank ready to be put into commission when cleansing of the other was necessary. The total capacity provided was equal to one day's dry weather flow, so that the sewage was given about 12 hours stay in the tank. At the inlet and outlet ends, weirs were constructed to distribute the flow over the whole width of the tank, thereby reducing the velocity and preventing disturbance of the sediment deposited in the bottom. Scum boards let into grooves in the tank further stilled the flow as well as preventing the egress of any solid floating matter, including grease.

"The tank effluent then flowed into a dosing chamber of about one gallon per square yard of filter capacity, the contents of which were discharged by an automatic syphon and then passed through cast iron pipes to the revolving distributors.

"The filters, built on concrete floors, were enclosed with 9-inch brick walls, which were found to be as cheap as dry built battered stone walls of greater thickness. The media consisted of broken stone in most cases, as clinker was extremely difficult to obtain, and was graded from 1 inch to 2 inches in size, with a bottom layer 6 inches deep of 3-inch material acting as a drainage layer. On top of filter 6 inches of 3-inch media was placed—The depth of media varied from 4 feet 6 inches to 6 feet, dependent on the fall available."

The effluent from the filters was discharged into humus tanks with a capacity of three hours' flow and, having deposited in these any solid matter washed out from the filter, the effluent was usually discharged direct into the nearest watercourse. In some cases there were no streams and the effluent was distributed over a small area of land or into the soil by sub-irrigation drains.

In those cases where the stream was used for a domestic water supply, the effluent from the humus tank was passed through sand filters 18 inches deep, with a bottom layer of fine gravel or clinker overlaid with coarse, sharp sand. The outlets to these filters were controlled by stop valves so that a few inches head of water could always be maintained on the surface. This treatment was also given to the effluent where it was to be discharged in the vicinity of oyster or mussel beds.

The sludge from the tanks was placed in trenches 3 feet deep and 2 feet to 4 feet wide which, when about three-quarters full, were covered with excavated material.

In some cases where the ground levels permitted, double filtration was given to the sewage, the primary filter containing two-inch media and the secondary filter one-inch media.

At each plant a printed set of rules for operation and management was hung up in the tool houses provided for the men in charge, giving full instructions for the daily routine work. Bottles were provided for taking daily samples of effluent. One man was able to look after each of the smaller works efficiently, being given assistance when the tanks were cleaned, but two or three men were found necessary for the larger works. Two inspectors had as their sole duty the making of periodical visits to the works to see that they were properly managed and good effluents obtained.

These aerodrome sewage plants included 75 gravitation schemes, including tank, filters, etc.; 20 pumping schemes discharging to disposal works, 20 pumping schemes discharging into sewers or sewage disposal works of local authorities, and 9 plants discharging into tidal waters. The plants included altogether over 750 miles of sewer.

Philadelphia Employs More Engineers

While a comparatively small amount of public work is being done in a number of cities and counties of the country, the city of Philadelphia has so much under way that an ordinance was recently passed authorizing the director of the Department of Public Works to employ additional engineers in the Bureau of Surveys to handle the greatly increased work in the district survey offices.

Refuse Destructor at Syracuse, N. Y.

The matter of disposing of the refuse of Syracuse, N. Y., is arousing controversy between the aldermen of that city. A few years ago a plant which had been operated by private parties was leased by the city and operated by it until it was wrecked by an explosion last year. To replace this, the city has been building a reduction plant on which it has already spent $250,000, and $94,000 additional is asked for completing it. An ordinance authorizing an issue of bonds for this amount was rejected by the common council a month ago, the opponents stating that the best and cheapest thing for the city would be to abandon the plant which is under construction and not throw good money after bad.

The figures presented by the opponents are disputed by Henry F. Goldacker, Deputy Commisioner of Public Works in charge of garbage disposal. The opponents stated that it would cost the taxpayers 12 cents to reduce a pound of grease, for which the city is to receive 6 cents. Mr. Goldacker replies that it does not cost anything like 12 cents to produce a pound of grease, and that grease can be sold in the market today at 9 cents.

Basing his estimate upon the cost to other cities, which he says is about $1.85 a ton, it will cost Syracuse this amount for operation and $3 a ton for collecting the garbage and delivering it at the plant. He is quoted as stating that one ton of garbage will produce about 400 pounds of grease worth about $36 at the present market price. (This is probably a mistake, as 55 to 85 pounds is the most obtained by other cities). In addition, it will produce about one quarter of a ton of tankage worth about $20. This leaves over $51 a ton for paying interest and depreciation on the plant. (Estimating 75 pounds of garbage and $5 for tankage—more probable figures gives $6.90). The annual collection of garbage in Syracuse is about 15, 700 tons, showing an operating profit of $803,000 a year, according to these figures. (Using the figures suggested by the editor gives $108,330, or 30 per cent of the cost of the plant, which should be ample to cover interest, repairs and depreciation).

Damage to Toledo's Filtration Plant

On August 2 the division wall between the two sedimentation basins in the filtration plant of Toledo, Ohio, collapsed, carrying with it a section of the roof of the basin. One basin was being filled when the wall collapsed, and the pressure of this water was the cause of the accident. What weakened the wall so that it was unable to sustain the pressure which it should have received with abundant safety had not been discovered at the time of this writing. It is expected that the basin, which is 100 feet wide and 500 feet long, will be cleared of the wreakage, which now occupies about two thirds of it, and ready for service again by about the middle of September.

Highway Construction in Illinois in 1920

Only one-fourth of this year's program can be completed, but this is equaled by no other state except Pennsylvania.

The Division of Highways of the state of Illinois claimed in the early part of August the work it had accomplished in constructing state highways this year was far in excess of that done by any other state except Pennsylvania, which was building about the same amount as Illinois.

In 1919 the department had let contracts for about 575 miles of roads, of which only about 175 miles was completed that year, leaving about 400 miles to be carried over into the present season. Contracts were awarded this year for fifty additional miles, but the department decided that it would be inadvisable to award any more contracts, for reasons already described in **Public Works** with reference to other states as well as Illinois.

With all of the efforts the contractors have been able to put forth, aided by the department, they have built this season only a little over one hundred of the 450 miles. If the contractors could have got deliveries of materials as required, fully twice as much pavement could have been laid without any additional expense to the state for supervision and very little additional overhead expense to the contractors.

As in other sections of the country, the delay was due to car shortage. In the latter half of 1919 the contractors were faced with a shortage of cars—first because of the strike of the railway car repairers, second because of the steel strike, and third because of an embargo placed on open-top cars due to the impending coal strike. Profiting by the 1919 experience, every effort was made by the contractors in 1920 to store sufficient sand, gravel, stone and cement to carry them well into the season; to this end they were given all possible assistance by the department.

It was found, however, that transportation conditions were worse than in 1919. First, came a more pronounced shortage of cars; this developed early in the year when it became impossible to get box cars for shipping cement. The cement companies resorted to the use of stock cars and open-top cars in order to overcome the shortage. Second, the shortage was greatly increased by the switchmen's strike. Third, the coal situation which tied up a very large number of cars for a considerable period of time became acute much earlier than usual, resulting in an order being issued by the Car Service Commission restricting the use of open-top cars to fifty per cent of the requirements of any producer of materials; and also providing that open-top cars could not be used for carrying commodities that could be as readily shipped in other classes of equipment. The order prevented the sand, gravel and stone products from getting sufficient cars to take care of the highway contractors; and also prevented the shipment of cement in open-top cars. Fourth, the order issued by the Car Service Commission was followed by an order from the Interstate Commerce Commission which provided that coal cars could be loaded with other commodities only when returning in the direction of the mines.

These two orders issued from Washington which are in effect at the present time have demoralized shipping conditions as applied to road building materials and made it impossible for the contractors to depend upon regular deliveries. Practically all of them have been obliged to shut down at frequent intervals because of the shortage of materials, some of them for weeks at a time. The department has kept in constant touch with the requirements of the contractors, with the material producers and railroad officials, endeavoring to assist in procuring cars and securing shipments of materials, so as to keep as many contractors as possible at work.

It requires about 450 cars per day to transport material for the highway work being carried on in Illinois and, assuming that it takes ten days for a car to make a round trip, it would be necessary to keep 4,500 cars in this service for the entire season.

More than forty contractors, many of them with two paving machines and several with three or more, have been in readiness to carry on this work since the early part of the season, but practically none of them have been able to operate more than one paving machine at a time.

In order to assist the contractors to obtain cement for the work, the highway department arranged some weeks ago for the shipment of 50,000 barrels of cement by barge from the plant of the Atlas Portland Cement Company at Hannibal, Missouri, to Alton and East St. Louis, this cement to be used on the National Old Trails Road and on the road from East St. Louis to Springfield. Up to August 7, 11,000 barrels had already been delivered and shipments were continuing, and it was expected that the entire shipment would be completed during the month of August.

In spite of these drawbacks, unless conditions become worse than at present most of the small contractors will have completed their contracts by the end of the season, while the larger contractors will have a very substantial part of their work done. There will be completed many stretches of pavement fifteen to twenty miles long and several stretches seventy to one hundred miles.

Although paving materials were difficult to obtain, this did not interfere seriously with other work on the highways which could be done, especially constructing small bridges and culverts and grading. In many places there are heavy fills to be made which will require at least a year's time for settlement before pavements should be laid on them. A few weeks ago contracts were awarded for eight sections between Vandalia and Carbondale and bids were called for on August 11 and August 25 covering several other sections. With this heavy grading completed, pavements can be built next year in continuous stretches where otherwise it would be necessary to postpone the paving of these embankment sections until the grading has settled.

Delays in Pennsylvania Highway Work

The State Highway Commissioner of Pennsylvania, Louis S. Sadler, on returning from a tour of the state on August 14, stated that the several hundred contracts now in force are being seriously hampered through the inability of the contractors to obtain shipments because of embargoes on open-top cars. There are 267 contracts in force at the present time involving the construction of 993.29 miles of highways. This season to date 109.24 miles have been completed, which mileage could have been more than doubled with reasonably favorable conditions.

Extensive Highway Construction For Indiana

Lorenzo H. Wright, director of the Indiana Highway Commission, announces the program for 1921 to cover the paving of 500 miles of road and the maintenance of 2,500 miles of road at an expense of $26,000,000 or more. It is expected that maintenance will cost about $3,000,000 and that $2,500,000 additional may be secured by doubling automobile license fees.

Denver's Municipal Asphalt Plant

The city of Denver plans to lay 115,000 square yards of asphaltic concrete this year, the estimated cost of which is something over $200,000. This amount has never previously been laid by the city in one season but it is believed to be possible this year because of improvements which have been made at the municipal asphalt plant which have doubled its capacity. This plant is now turning out sufficient material to pave an average of 2,000 square yards a day, as much as 2,400 square yards having been laid in a day.

By the middle of July the city had laid 29,600 square yards on one street at a cost of $45,355, and 48,370 square yards on another street was nearing completion at that time.

Some of the streets to be paved this year are already paved with concrete, on which the asphaltic mixture will be laid after the surface of the concrete has been thoroughly cleaned. One district which will be paved this year was to have been paved six years ago at a cost of $1.64 per square yard but the property owners protested against it. They are now asking for the pavement although it will cost them $2.75 per square yard, the total area to be paved being 18,900 square yards.

The improvements at the asphalt plant, in addition to increasing capacity, have also increased the economy of operation, and it is estimated that $10.80 per ton will be saved in the purchasing and handling of the asphalt used at the plant. The saving in purchasing is due to the fact that the city is now able to order in carload lots, which permits a saving of $7 per ton over purchasing by the barrel which was necessary formerly. In addition, there was formerly a loss of asphalt in removing it from the barrels, which is now eliminated. This loss and the freight on the barrels is estimated by the superintendent of the municipal asphalt plant, Charles L. Draney, to amount to about $3 a ton.

The city orders asphalt in lots of five car loads. The asphalt is heated by the steam coils in the cars and run into a tank 40 feet long, 13 feet wide and 9½ feet deep. At the bottom of this tank are steam coils which keep the asphalt continuously heated and ready for pumping. From this tank the asphalt is pumped without any delay to the mixing plant.

Saving in handling at the plant is due mainly to the installation of a derrick and an asphalt pump and storage tank. By means of the derrick, using clam-shell buckets, the city is able to unload material and store it, and transfer it from the stock pile to the mixing plant more rapidly and economically than before, the derrick eliminating the use of three teams. For storing the material there has been built a three-compartment bin holding crushed slag and two grades of sand. The use of this bin prevents any intermission in the continuous operation of the plant waiting for one or another of the mineral aggregates.

The saving made at the plant is indicated by the pay roll last year and this, although this does not allow for the increased output of this year. The roll is made up twice a month, and beginning with the second half of March of 1919 and of 1920 respectively, the pay rolls were as follows: $2,533, $2,615; $3,345, $2,915; $3,659, $2,704; $4,744, $3,457; $4,515, $3,419.

In addition to the improvements at the plant, the department has added to its street equipment a conveyor and a heavy scarifying machine drawn by a caterpillar tractor. Two men at $8 per day on the conveyor take the place of eighteen shovelers at $4 a day. The use of the caterpillar-drawn scarifier replaces a considerable number of light, horse-drawn scarifiers and blades and is estimated to save nearly $100 a day; in addition to which the new machine cuts deeper and prevents the marcel wave effect left by the light machines.

Recent Legal Decisions

MATERIALMAN'S LIEN GOOD AS AGAINST ASSIGNEE OF CONTRACTOR

A road contractor entered into an agreement whereby he assigned his contract to one who financed him and who was to receive a specified portion of the proceeds. It is held, Stansbury v. Frazer, (Cal.) 189 Pac. 495, that the lien of one furnishing material to the contractor, and who filed with the county the notice of claim required by California Code Civ. Proc. § 1184, entitles the materialman to bonds or money due from the county to the contractor as against the assigne. It would make no difference whether or not the contractor took a subcontract under his assignee and the materials were furnished to the subcontractor.

IMPROVEMENT CONTRACTOR'S BOND PROTECTION TO MATERIALMAN

In a suit against the surety on the bond of a contractor with a city for a reinforced concrete floor for a viaduct in the city, the Ohio Supreme Court hold, Royal Indemnity Co. v. Northern Ohio Granite & Stone Co., 126 N. E. 405, that the rule of strict construction ordinarily applied in favor of privvate, voluntary sureties does not apply to the class of sureties which, for a pecuniary consideration, undertakes to indemnify an owner of a construction against the defaults of the principal contractor. In such contracts, where ambiguous terms are employed, that construction should be adopted, if consistent with the purpose to be accomplished, most favorable to the beneficiary. And a surety of this character, which, by its contract, assures the faithful performance thereof by a principal who agrees to furnish labor and materials on a structure, at his own risk, cost, and expense, is liable to a materialman who furnishes material, in default of the principal's payment therefor. Where contracts for improvements are entered into between an owner and a surety, which receives a premium for its engagement of fidelity, terms may be employed which fairly contemplate that financial protection of subcontractors, who employ labor and furnish material for the structure contemplated in the bond.

EMPLOYEES CANNOT SUE FOR WAGES UNDER NEW YORK STATE HIGHWAY CONTRACTOR'S BOND

The New York Court of Appeals holds, Fosmire v. National Surety Co., 127 N. E. 472, that a bond given by a highway contractor, under New York Highway Law, § 130, Subd. 7, conditioned for performance and completion of the contract within the time prescribed and for the protection of the state against excess cost, damages, etc., and for payment of wages, gives a cause of action in favor of the people only, and not in favor of a laborer for unpaid wages due from contractors to himself and fellow laborers under assignments. The dominant purpose of the bond, the protection of the state, would be defeated if laborers may ignore the public and sue in their own right. They may then sue for wages as often as there is default, and, exhausting the penalty of the bond, leave nothing for the state. The state did not intend to make the employees of its contractors the beneficiaries of a cause of action to be enforced in hostility to its own. A different question would arise if the bond had been conditioned for the payment of wages and nothing else. The interest of the state in the welfare of those who labor on its public works might then point to an intention to create a cause of action in their favor.

AGREEMENT AS TO MEASUREMENT OF SAND AND GRAVEL SOLD—RIGHTS OF MATERIALMEN FIXED BY LAW

Where a contract for material specifically stated the gravel was to be delivered at 2,600 pounds to the yard and sand at 2,400 pounds to the yard, these terms governed the parties and the purchaser could not change the form of measurement and employ a man to measure the sand and gravel under the reformed measurement without the knowledge or consent of the seller. The Louisiana Supreme Court also holds, Thompson v. O'Leary, 84 So. 116, that a contract of sale of cement prividing that "the usual credit of 10 cents each will be given on all empty cement sacks returned in good condition to the S. Cement Co., at Rockmart, Ga.," contemplated that the purchaser should stand the expense of delivering the empty sacks at the place designated.

The contractor having difficulty in giving a bond, the surety required him to have materialmen waive any lien or privilege they might have on the building to be constructed. It is held that a letter signed by the materialmen and addressed to the surety, waiving their rights of lien on the building, did not modify in any way contracts between the materialmen and the contractor. The waiver only affected the surety. Furnishers of materials for a warehouse constructed for the port commission of New Orleans served attested accounts upon the commission at a time when it had funds in its hands to the credit of the contractor more than sufficient to meet the several demands. The materialmen were held entitled to a judgment against the port commission for the amounts due from the contractor. The rights of materialmen are fixed by law, and nothing that the owner can do can change them.

LIMITATIONS OF BUILDINGS IN TOWNS AND CITIES

The Massachusetts Supreme Judicial Court holds, in re Opinion of Justices, 127 N. E. 525, that a proposed act, House Bill No. 1660, to authorize cities and towns to limit buildings according to their use or construction, is not violative of any of the provisions of the federal Constitution or its amendments.

NEWS OF THE SOCIETIES

COMBINATION ASPHALT KETTLE AND STEAM BOLER

Sept. 7-10—NEW ENGLAND WATER WORKS ASSOCIATION, Annual convention, Holyoke, Mass. Secretary, Frank J. Gifford, 715 Tremont Temple Boston, Mass.

September 13-16 PACIFIC COAST ASSOCIATION OF FIRE CHIEFS. Annual convention Los Angeles, Cal. Secretary, H. W. Bringhurst, Seattle, Wash.

September 13-17—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual meeting San Francisco, Cal. Secretary, A W Hedrich, 169 Massachusetts Ave., Boston, Mass.

Sept. 16-18—ENGINEERING INSTITUTE OF CANADA. Meeting to be held at Niagara Falls, Ontario.

Sept. 20-23 — SOUTHWESTERN WATER WORKS ASSOCIATION, Annual convention, St. Charles Hotel New Orleans, La. Secretary, E. L. Fulkerson, Waco, Texas.

Oct. 12-14—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. St. Louis, 401 [illegible] Avenue, Valparaiso, Ind.

October 13-15—AMERICAN CIVIC ASSOCIATION. Annual convention Amherst, Mass. Secretary, E. F. Marshall, Union Trust Bldg., Washington, D. C.

October 16-19—AMERICAN COUNTRY LIFE ASSOCIATION. Annual conference Springfield Mass. President. Kenyon L. Butterfield. Amherst, Mass.

Oct. 19-22—INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. 25th annual convention, New Orleans, La. Secretary, C. R. George, Houston, Texas.

NEW ENGLAND WATER WORKS ASSOCIATION

The 39th Annual Convention will be held at Holyoke, Mass., Sept. 7-10. The office of the Secretary will be open at the Hotel Nonotuck at 8 A. M., September 7th, for registration. Registration cards will be sent to fill out and bring to the Convention.

Hotel Rates per Day, $1.50, up. Owing to the limited number of rooms available in the hotels, arrangements have been made to secure rooms in private homes.

For all information in regard to rooms, and for assignment of same, write Patrick Gear, Supt. Water Works, Holyoke, Mass

EXHIBITS

Exhibits to be located in the City Hall Water Works Manufactures Association Committee. Burt B. Hodgman, Chairman, 50 Church Street, New York. N. Y. The New England Water Works Asociation Committee. Harry H Kinsey, Chairman, 201 Devonshire Street, Boston, Mass. Information regarding space for exhibits may be obtained from Burt B. Hodgman, Chairman.

PROGRAM OF PAPERS

(It may be necessary to make some changes in this program, two or three additional papers are expected, but cannot be announced at this time.)

Tuesday Afternoon, Sept. 7th, 1920, 2 o'clock.

Address of Welcome. Hon. John F. Cronin, Mayor of Holyoke; Mr. Thomas J. Carmody, Chairman Holyoke, Water Commissioners.

The Holyoke Water Works, and its Rainfall and Stream Flow Measurements, by Patrick J. Lucey, Engr., Holyoke Water Works. Final Report of the committee on Runoff. Robert E. Horton. Chairman. *(Have you measured any streams? Bring your dope.)*

TUESDAY EVENING SEPT. 7, 1920 8 O'CLOCK

Experiences with Quicksand, by Col. Charles R. Gow, Cons. Engr, and Contractor, Boston, Mass. *(Come prepared to add your tale of woe.)* Final Report of Committee on Charges for Private Fire Protection, William C. Hawley, Chairman. *(The insurance men will doubtless have something to say.)* Report of Committee on Assessments for Main Pipe Extensions, Caleb Mills Saville, Chairman.

WEDNESDAY FORENOON, SEPT. 8, 1920, 9 O'CLOCK

Protecting Surface Water Supplies against Contamination, by X. H. Goodnough, Chief Engr., Mass., State Dept. of Health. *(What do you think of fishing in reservoirs?)* Some Color Characteristics of Unstripped Reservoirs by Caleb Mills Saville, Manager and Chief Engineer, Hartford Water Works. The Peabody Epidemic of 1913, and its Connection with the Water Supply, by Arthur D. Weston, Principal Assistant Engr., Mass., State Dept. of Health. *(A practical warning.)*

WEDNESDAY AFTERNOON, SEPT. 8, 1920, 2 O'CLOCK

Innocence or Repentance in Drinking Waters, by Harry W. Clark, Chemist, Mass., State Dept. of Health. *(Massachusetts' typhoid rate is one of the lowest, without chlorination of waters. What is the answer?)*

Lead Poisoning, Its Cause and Prevention, by Robert Spurr Weston, Consulting Engineer, Boston, Mass. A New Reinforced Concrete Pipe, by George C. Bartram, of United Concrete Pipe Co, of New York City. Progress Report of Committee on Standard Specifications for Cast Iron Pipe, Frank A. McInnes, Chairman. *(Two members of the Committee have recently visited some of the pipe founderies, and have matters of interest to report)*

WEDNESDAY EVENING, SEPT. 8, 1920, 8 O'CLOCK

(In view of the present and probable future cost of fuel, efficiency in pumping is of prime importance. What are you doing in this direction? Come and tell us?) Further Tests of the Unaflow Pumping Engine, By D. A. Decrow, of Worthington Pump & Machinery Corporation, New York, N. Y. Comparative Cost of Pumping by Steam and Hydraulic Power at Manchester, N. H., by James H. Mendell, Supt. Manchester Water Works Modern Pumping Station Design and Operation, by Reeves J. Newsom, Commissioner of Water Supply, Lynn, Mass.

THURSDAY FORENOON, SEPT 9, 1920, 9 O'CLOCK

The Chicopee Standpipe by A. P. Manan, Engr., Walsh's Holyoke Steam Boiler Works, (Builders of the Standpipe). *(This standpipe is of unusual size, and its design is a matter of considerable interest.)* Loss of Head in a 12-in Gate in a 16-in. Pipe by Thomas E. Lally, Asst. Engr., Water Dept., Boston, Mass. *(To what extent is it good practice to use gates of smaller size than the pipe in which they are located?)* The Relation between Office Methods, Regulations and the Water Consumer, by Reeves J. Newsom, Commissioner of Water Supply, Lynn, Mass., *(Good regulations are essential to good relations with water takers.)* Instructions to Employees at Pumping Stations and Filter Plants, by Dow R. Gwinn, President and Manager Water Co., Terre Haute, Ind. *(Methods used by a progressive and public spirited corporation.)*

FRIDAY FORENOON, SEPT. 10, 1920, 9 O'CLOCK

General Discussion on Experience with Trenching Machines, to be opened by George W. Batchelder, Water Commissioner, Worcester, Mass., and A. E. Martin, Supt. Water Works, Springfield, Mass. Interchange of Construction Plant between Water Departments, by Henry V. Macksey Supt. Public Works, Framingham, Mass. *(To what extent is it feasible to utilize plant to its fullest capacity by interchange?)*

FRIDAY AFTERNOON, SEPT. 10, 1920. 2 O'CLOCK

Special Superintendents' Session—Practical Problems.

Experience with an Exploded Pressure Boiler, and Check Valve on Service Pipes, by Edward J. Looney, Supt. Water Works, Belmont, Mass. Some Practical Points of Interest to Water Works Officials of Benefit to the Consumer, by David A. Heffernan, Supt. Water Works, Milton, Mass. Some Practical Experience with Distribution Systems, by George H. Finneran, Supt., Boston Water Works.

FRIDAY EVENING, SEPT. 10, 1920. 8 O'CLOCK

Operation of a True Siphon on a Main Supply Pipe, by W. R. Brann, Supt. Water Works, Hallowell, Me., and Charles W. Sherman, of Metcalf & Eddy Consulting Engrs., Boston, Mass. *(A part of this pipe is higher than the reservoir from which the supply is drawn.)* Water Waste Surveys in Boston, by Frank A. McInnes, Division Engineer, Boston, Mass. *(Where does the water go?)*

ENTERTAINMENTS

Tuesday afternoon. A whist party for the ladies at the Holyoke Country Club.

Tuesday evening. A whist party for the ladies at Hotel Nonotuck.

Wednesday morning. A visit will be made to the International Steam Pump Company Works; and to the Testing Flume of the Holyoke Water Power Company

Wednesday afternoon. Auto trip for the ladies

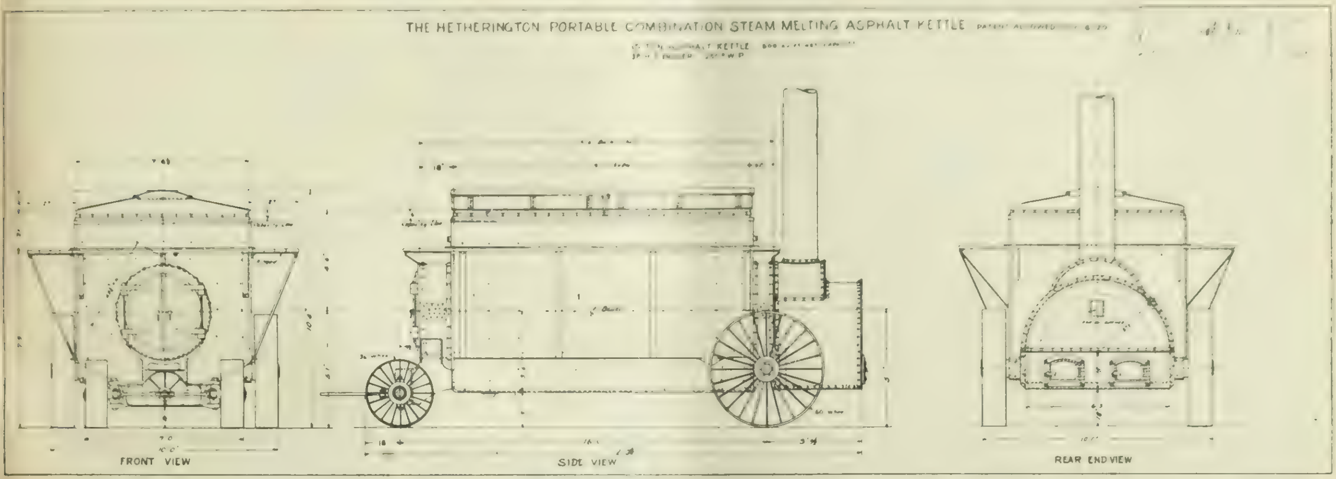
Friday morning a trip by auto will be made to the Holyoke reservoirs

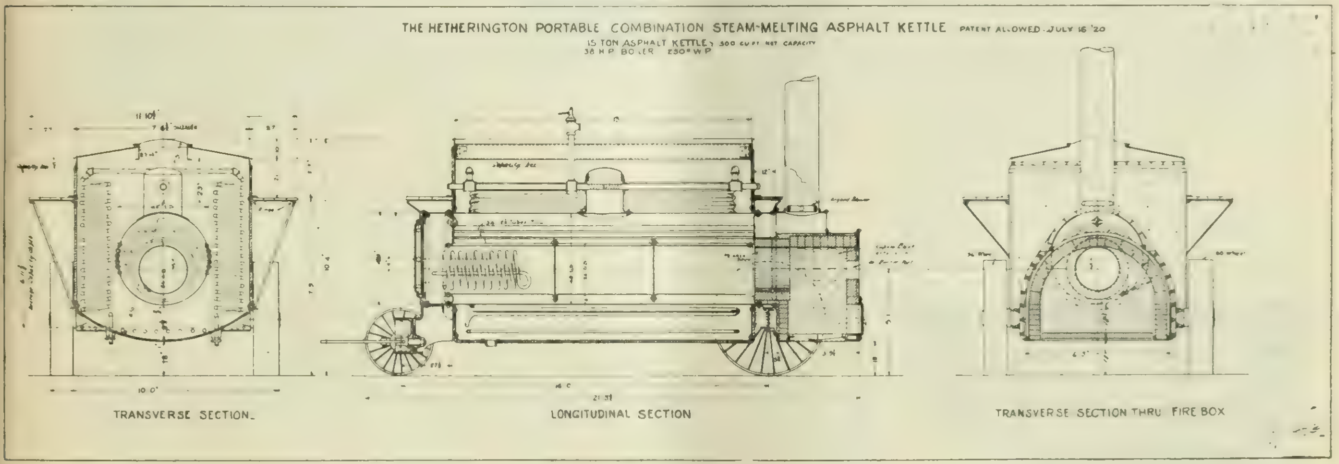
New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

COMBINATION ASPHALT KETTLE AND STEAM BOILER

A patent has just been allowed to Carl F. Hetherington of Indianapolis, Indiana, on an asphalt kettle which contains some quite novel features. The most apparent of these is the general idea of constructing an asphalt kettle surrounding a steam boiler. Both kettle and boiler may be given any desired capacity. The illustration shows a combination with a kettle capacity of 15 tons of soft asphalt and a boiler capacity of 38 to 40 h.p. Designs have been prepared for others with 8 tons kettle capacity and 10 to 12 boiler h.p., and 3 tons kettle capacity and 50 boiler h.p.


THE HETHERINGTON PORTABLE COMBINATION STEAM MELTING ASPHALT KETTLE PATENT ALLOWED
FRONT VIEW
SIDE VIEW
REAR END VIEW


THE HETHERINGTON PORTABLE COMBINATION STEAM-MELTING ASPHALT KETTLE PATENT ALLOWED JULY 16 '20
15 TON ASPHALT KETTLE, 300 CU FT NET CAPACITY
38 H P BOILER 250# W P
TRANSVERSE SECTION
LONGITUDINAL SECTION
TRANSVERSE SECTION THRU FIRE BOX

The boiler is a plain cylindrical flue boiler with the addition of return tubes, being thus somewhat akin to a Scotch marine boiler. It is designed for 200 to 250 pounds working pressure, A. S. M. E. specifications. The shell of the boiler is extended sufficiently beyond the front and rear tube sheets to form a support for the front and rear axles respectively, and also at the rear end to form an attaching ring for the fire box. The fire box is arranged with grates and also provided for burning fuel oil, so that either fuel may be used at will and without any rearrangement. The boiler containing water or steam in contact with its entire circumference and length, the asphalt in the kettle is in contact only with a steam or hot water heated surface and, as the furnace gases at no point come in contact with the outer shell of the boiler, the asphalt is at no point heated beyond temperature of the steam. Consequently those contractors who favor steam melting or are obliged by specifications to use only the steam melting system will appreciate this feature of this melting plant.

For use with the harder asphalts there is provided a steam super-heater coil in the front end of the boiler flue. This would not be required for the softer asphalts, but in using Trinidad asphalt better time could be made in melting it and the heavier ingredients of the material kept in agitation by using the super-heater coil for blowing steam. The plant is so designed that this coil may be readily removed or replaced in a few minutes without interfering in the operation of the plant.

In addition to the heating surface provided by the external surface of the boiler shell, steam coils are provided so that lump asphalt may be melted down and its temperature raised to 320 degrees Fahrenheit within six or eight hours after charging the kettle. These coils are arranged in banks which are easily removed from the top of the kettle, although it is probable that there would never be any occasion to remove them during the operating season because the coils are made of continuous welded extra heavy pipe.

The exterior surface of the kettle, which surrounds practically the entire length of the boiler, is lagged with a first class insulating material and this in turn protected by a sheet metal covering.

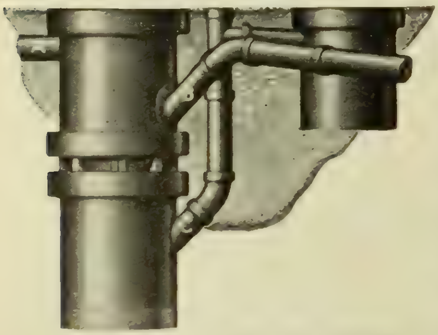
The combined plant is carried on four wide-faced traction wheels. The axle being pivoted in the center so that the superstructure is entirely protected against twisting strains in movement over the roads. A short drawbar connects with a transverse tie bar between the steering knuckles so that ease in hauling and steering and in making short turns is assured.

The boiler can be used not only for heating the asphalt in the kettle but also for furnishing the steam for melting asphalt received in tank cars, permitting the mixing plant to be run by electric motor if necessary and doing away with the necessity for a stationary boiler at the plant. In case the asphalt is received in barrels, as may be necessary when the road job is at some distance from the nearest railroad siding, the combination boiler and kettle here described can be used to advantage. There is but one unit to be transported over the road, and the boiler will furnish sufficient steam to melt down over night sufficient A C for a day's run (say 1200 to 1500 square yards of standard 2-inch sheet asphalt surface, or 1600 to 1800 square yards of bituminous concrete) and to maintain it at 300 to 320 degrees throughout the day; also to run a 25 to 53 h.p. engine or even larger.

No definite arrangements have yet been made for the manufacture of the combination steam melting kettle and boiler, but Mr. Hetherington expects to take up negotiations in the near future so that these melting kettles may be on the market for early spring deliveries next year.

FERGUSON SEWAGE DISPOSAL SYSTEM

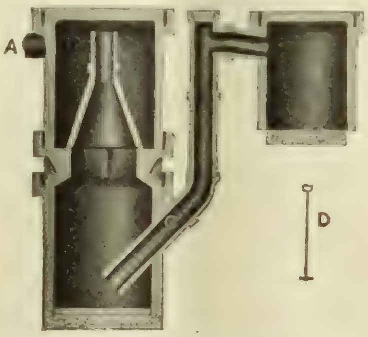
A system and apparatus for disposing of the sewage of residences and institutions has been placed on the market by the Ferguson Segment Block Company of St. Louis, Mo. The apparatus consists of two tanks, one a two-story tank consisting of settling chamber and digestion chamber, and the other being a discharge chamber. The tanks are made circular in plan and are constructed of vitrified sewer pipe with a few special parts, as shown in the illustrations. The sewage enters through the pipe into the upper chamber of the two story tank, where the solids settle out and drop into the bottom chamber through the annular space around the bottom of the cone, accompanied by more or less of the liquid. The liquid leaves the tank through the pipe B and is carried to either a stream where it can be discharged, or to an underground irrigation system consisting of drain tile with open joints, laid 18 inches below the surface of the ground.



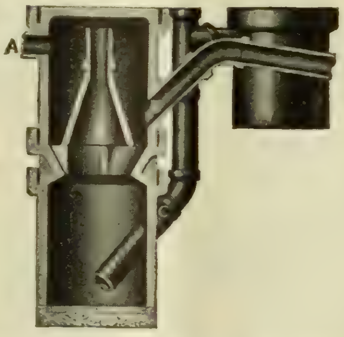
GENERAL VIEW OF SYSTEM

The gases from decomposition rise inside of the cone and escape through the opening at the top of it, thus not interfering with the settling out of the solids in the surrounding space.

The sludge gradually decomposes in the bottom chamber and about once every six months it is pumped into the discharge chamber by use of a simple plunger piston with a valve, which operates in the extractor pipe C, by simply working the pump up and down in the vertical part of that pipe. The discharge chamber is of only sufficient size to allow a limited amount of sludge to be taken from the digestion chamber at any one time, the idea being to prevent withdrawing undigested sludge. The sludge is left in the discharge chamber until it is thoroughly dry and of the nature of humus when it is spaded out like so much earth. If there is a large stream available, the digested sludge may be pumped into this and the discharge chamber omitted.



SECTION THROUGH EXTRACTOR PIPE AND DISCHARGE CHAMBER



VERTICAL SECTION OF TWO-STORY TANK

Where the system is to provide for the sewage of more than fifty people the tanks are built with patented blocks, but the systems are the same in principle as those just described. However, underground irrigation is not generally practicable for such large plants, but some sort of sand filtration bed is more satisfactory. But for these large plants different cases require individual solutions.

The entire plant is installed underground, with the tops of the two-story tank, of the sludge extractor pipe, and of the sludge discharge chamber on a level with the surface, each of these being provided with a cover.

The standard models vary from one to 24 inches in diameter and 6 feet 10 inches deep for from one to five people, to one 36 inches in diameter and 13 feet 4 inches deep for from twenty to thirty people.

PERSONALS

Field, W. P., consulting engineer of Newark, N. J., died at West Orange, Aug. 8. He had constructed a number of large armories and manufacturing plants in New Jersey.

Larner, H. B., has been appointed health officer at Montclair, N. J.

Chase, W. G., formerly chief engineer of the Greater Winnipeg Water District, Canada, has been appointed manager of the Canadian Lock Joint Pipe Company with headquarters at Toronto.

Milne, Alex. has been elected president of the canadian section of American Water Works Association.

Dobbin, R. L., has been elected secretary of the Canadian section of the American Water Works Association.

Eaton, A. B., City Engineer of El Dorado, Kans., has resigned that position and accepted charge of a paving contract at Bartlesville, Okla.

Benedict, R. R., has been appointed assistant to chief highway engineer of the State of Illinois, Department of Public Works and Buildings.

Crawford, Colonel C. H., manager of the Baldwin Locomotive Works, Rio de Janeiro, S. A., has been appointed by the national Executive Committee of A. A. E. as "Chief Representative to the Latin American Republic."

Blanchard, A. H., professor of Highway Engineering and Highway Transport at the University of Michigan, has recently been appointed consulting engineer to the Michigan State Highway Department.

Sherman, LeRoy K., until recently president of the United States Housing Corporation at Washington, D. C., has become vice-president of the Edmund T. Perkins Engineering Company, First National Bank Building, Chicago. Mr. Sherman is president of the American Association of Engineers and was formerly engineer member of the Illinois River and Lakes Commission. The firm will conduct a general practice as consulting and supervising engineers in municipal, sanitary, and structural work, in addition to their past specialty of land drainage and reclamation.

HARLAND BARTHOLOMEW

Mr. Bartholomew announces the opening of new offices in the Compton Building, St. Louis, Missouri, for professional practice in city planning and allied subjects.

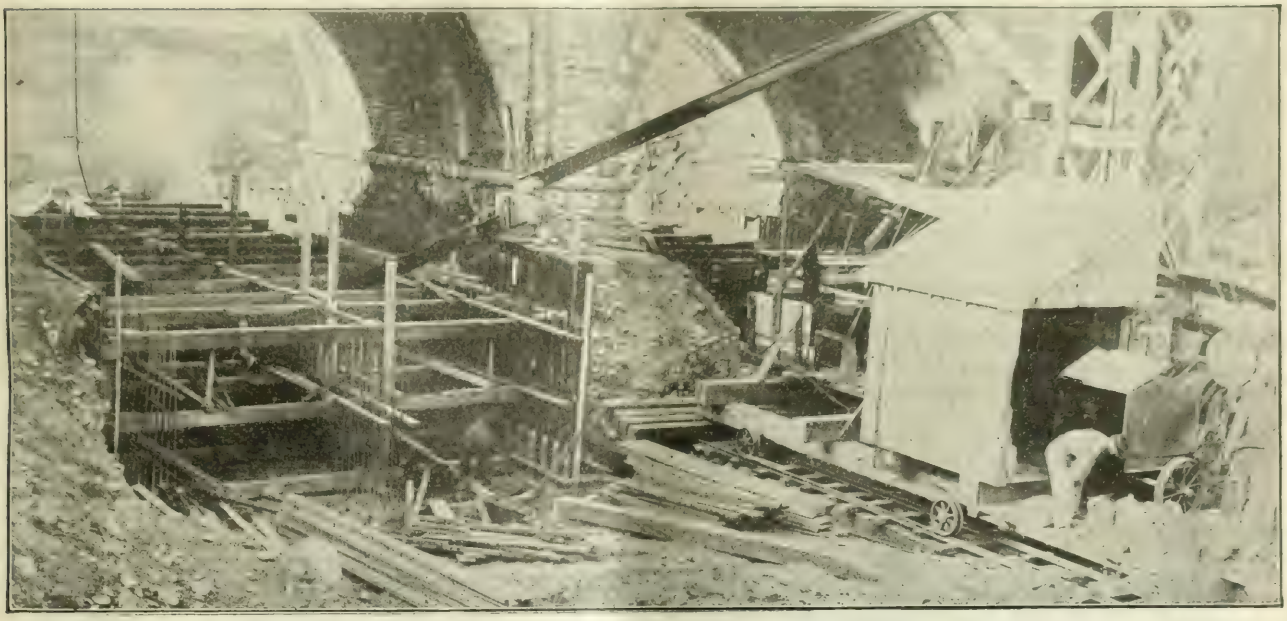
Mr. Bartholomew has directed the preparation of the comprehensive plan for St. Louis; has served as consultant to Omaha, Detroit and Pittsburg, and to the Commissioners of the District of Columbia appointed to prepare a zone plan for Washington, and has been retained to draw up complete city plans and zoning ordinances for a number of cities.

Associated with Mr. Bartholomew are: R. P. Hoffmann, Architect; Earl O. Mills, City Planner; and L. Tilton, Landscape Architect.

PUBLIC WORKS.
CITY COUNTY STATE
A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"
Vol. 49 FLORAL PARK, SEPTEMBER 4, 1920 No. 10

Excavating Below Arch Bridge Foundations

Concrete conduits 25 feet wide constructed on opposite sides of a railroad bridge pier and carried down 12 feet below the pier footings on gravel retained by steel sheet piles.



CONCRETING FLOORS AND SIDE WALLS OF TAIL-RACE CONDUITS UNDER TWO 30-FOOT BRIDGE SPANS

Among the operations involved by the improvement and flood protection work of the Miami Conservancy Commission was the construction of a tail-race for the Fordson tractor plant at Hamilton, Ohio. This conduit is an open channel with a normal cross-section 50 feet wide and a concrete floor and sidewalls. The floor is 6 inches thick and the sidewalls, 4½ feet high, taper from 3½ feet thick at the base to 1 foot thick at the top.

In order to pass under a four-span railroad arch bridge, the cross-section of the conduit was modified for a short distance to form two rectangular branches 20 feet wide and 8 feet high inside, each branch passing under one of two adjacent center arches of 30-foot spans. The bottoms of the conduits are about 12 feet below the bottoms of the old pier footings and the adjacent sidewalls of the conduits only about 6½ feet from the center line of the pier supporting the arches. These dimensions, necessitating excavations far below and very near the old footings on loose treacherous ground below water level, made the construction problem a difficult one.

The arches and spandrel walls of the bridge are of stone masonry in rather poor condition, with some cracks and settlement and with some voussoir stones fallen from the arch rings. The foundation of the center pier between these conduits was very shallow and had a timber grillage footing only about 10 feet wide resting on gravel and boulders 4 feet below the bottom of the river and 12 feet above the bottom of the conduit excavation.

To prevent undermining of the center pier and the two adjacent piers, a row of interlocking steel sheet piles less than 3 feet clear of the footings was driven parallel to the conduits on both sides of each and extending beyond the upstream and downstream sides of the bridge, forming retaining walls for the trenches excavated between them for the conduits.

At the time of construction there was no water flowing under the bridge and the ground water, although having a natural level about 6 feet above the bottom of the excavation, was well drained by regular pumping in the supply wells of the Hamilton waterworks, so that there was only a moderate amount of seepage water in the excavation, which was removed by a centrifugal steam pump superseded by a Worthington duplex pump, both operated by steam obtained from the Baltimore & Ohio Railroad pumping station nearby.

All of the earth under the two main spans of the bridge, over each conduit, consisting chiefly of mud, gravel and boulders, was removed by hand excavation and wheelbarrows down to a depth of about 6 feet, slightly below the bottoms of the old pier grillages.

The hand work was supplemented by slip scrapers and when the excavation had reached a depth of about 8 feet below the original surface, lines of ranger timbers are laid parallel to the axis on both sides of each conduit, and the four rows of steel sheet piles were assembled and driven adjacent to them.

The rangers were braced and the excavation continued about 4 feet farther, another set of rangers and braces placed and a center trench dug in each conduit, in which there was laid a narrow-gage service track for steel side-dump cars into which the remainder of the material was shoveled and hauled out from under the bridge where it was dumped in a spoil bank, removed by a dragline excavator installed there for the construction of a protection levee close to the bridge. As the excavation progressed, a third set of rangers and transverse braces was placed in each trench, holding the sheeting so firmly that no displacement occurred and there was no undermining of the bridge piers or settlement of the old structure.

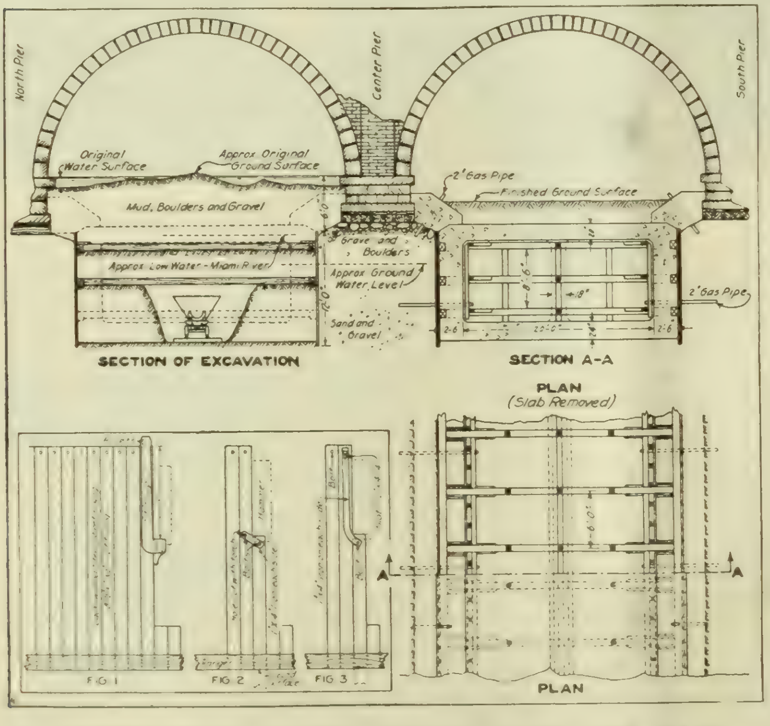
SHEET-PILE DRIVING

When the sheet piles were assembled for driving, there was only 12 feet of vertical clearance between the bottom of the excavation and the arch span overhead and, as the piles were 12 feet long, there was no room to operate the steam hammer in the usual manner. A special arrangement was, therefore, devised that permitted the hammer to be set below the pile top and was successfully developed for the satisfactory installation of the piles.

At first a riveted stirrup 5 feet long was made to hang on top of the pile and provide a shoulder on the face of the pile near its middle point to receive the hammer blow. This was subject to very severe vibration, proved inefficient, and was abandoned. Another stirrup, shown in Fig. 1, was designed with the hammer seat concentric with the forward edge of the pile and gave better results but broke in the angle at the foot. It was replaced with a heavier one of the same type, shown in Figure 1, with which the work was completed.

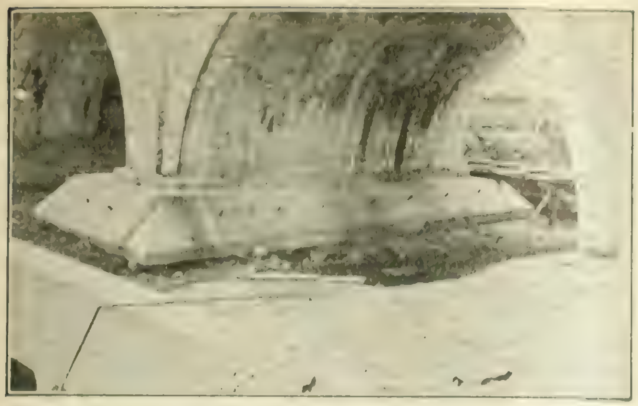
The operation of the hammer with the stirrup was so slow that attempts were made to drive the piles in 5 and 7-foot sections, spliced together and staggering joints. This idea was abandoned on account of the possibility of weakening the structure and impairing its water-tightness, and efforts were made to drive a 7-foot pile and insert a 12-foot pile in its place, but these were abandoned because the hole filled up with gravel before the long pile could be inserted. Another method tried was to drive one pile half way, attach a second one to it and drive the first one the remaining distance carrying the other one down with it and then attaching a third to the second, completing the driving of the second and so on. This was at first done by connecting the two piles with a short transverse link, shown in Figure 2, where the load on the connection bolts was so great as to shear through the pile web. The short link was finally replaced by the long one shown in Figure 3, which operated satisfactorily and was used for the remainder of the work.

After this plan had been perfected about 9 piles, as many as could be conveniently handled in one group·



CONSTRUCTION OF TWIN CONDUITS UNDER ARCH SPANS

Details of Stirrup and Link Devices for Driving Steel Sheet Piles in Limited Headway



CONCRETE PROTECTION BETWEEN BRIDGE PIER AND CONDUIT ROOF

were assembled and interlocked in a horizontal position on the surface of the ground, revolved into a vertical plane, set against the ranger in the required position, and the first pile driven down 5 feet by means of the stirrup shown in figure 1.

The stirrup was then removed and the long link shown in figure 3 was attached to the first and second piles and the first pile driven down to the full length, carrying with it the second pile. The links were then shifted to connect the second and third piles, the driving of the second pile was completed, the links again shifted to third and fourth piles, the driving of the third pile completed and so on, until the piles were completely driven, after which another group of piles were assembled and driven adjacent to them in the same manner.

. The steam hammer was handled by a light wooden tripod traveler about 15 feet high, mounted on rollers. Its hammer was raised and lowered by a hand windlass mounted on the traveler platform with its hoist line over a sheave movable on the overhanging cap of the traveler, which enabled it to be so displaced transversely so as to seat the hammer on the pile top or alongside as required.

So many boulders were encountered that the driving was slow, 12 hours sometimes being required to drive a single pile, altho' on other occasions as many as 16 piles could be driven in one 10-hour shift.

CONCRETING

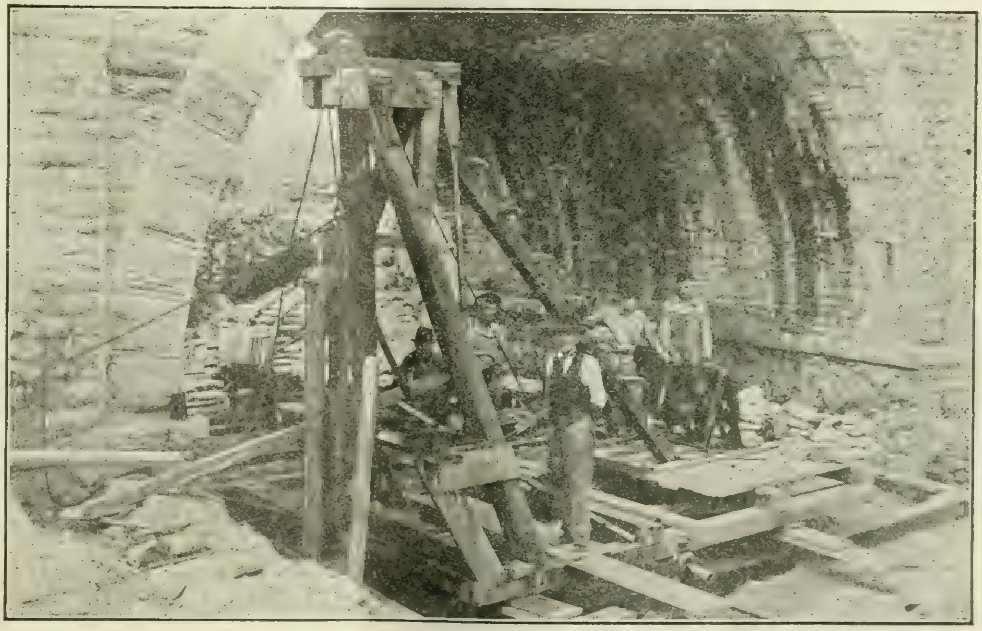
After the excavation had been completed the floor concrete (much thicker than that of the open conduit) was laid in sections 15 feet long and after it had set, wooden forms were built on it for the sidewalls and roof and were thoroughly braced inside with vertical and horizontal struts to resist the weight and pressure of the wet concrete.

The concrete plant consisted of a mixer and hoisting tower installed on a rolling platform that moved along the work to provide the concrete for the remainder of the tail-race. The concrete was spouted through a steel chute to the required position in the forms and completed each section of roof and sidewalls at one operation.

On the center line of the roof of each conduit, rectangular 6 x 12-inch holes were left open 12 feet apart on centers and after the concrete had hardened and the forms had been removed, new forms were built in the center of each conduit for a longitudinal supporting wall that was concreted through the holes previously left in order to give additional support to the roof for a future occasion when the latter will be required to carry an earth fill that may be deposited when the superstructure of the bridge is widened.

The roofs of the conduits serve as horizontal braces to resist any possible exterior lateral pressure against the sidewalls of the conduits and the steel sheeting, which is left permanently in position.

The spaces between the tops of the sidewalls and the arch piers were filled with continuous masses of concrete that were continued around the ends of the piers, really forming extensions to the pier footings, increasing their bearing area, and providing for the distribution of thrust between piers and conduits, as well as furnishing a



STEAM HAMMER DRIVING SHEET STEEL PILES AND HANDLED BY HAND WINDLASS ON TRAVELER revetment and entirely inclosing the ground surface under the piers and thus protecting their foundations.

Numerous 2-inch gas pipes were cast in the revetment and in the lower part of the conduit walls which, after the conduits had set, were utilized for grouting which was executed under air pressure and continued until all of the air and water had been expelled and the grout flowed out of the upper tier of pipes.

This work, which was described in the Miami Conservancy Bulletin of July 3, was executed under the direction of the Miami Conservancy District, Arthur E. Morgan, chief engineer, and Chas. H. Paul, assistant engineer, and under the general supervision of J. H. Kimball.

Good Roads Committees in Ohio

The Ohio State Automobile Association is to organize a good roads committee in each county of the state, according to Charles C. Janes, secretary of that organization. The object is the promoting of an enlarged system of improved roads. There is already in Ohio the Ohio Good Roads Federation, but the State Automobile Association believes that it can give additional weight to the movement for good roads by the county organization proposed. It is proposed that the auto club or clubs in each county appoint a member for that county, and that the members from the various counties then get together for the purpose of working out a good roads program for the future.

Street Paving in Philadelphia

Nearly $8,000,000 of work being executed this year on 1,800 miles of streets and roads, League Island Park and Roosevelt Boulevard. Concrete delivered by auto truck service from central mixing plant.

The Bureau of Highways, Department of Public Works, of Philadelphia has charge of the construction, maintenance and repairs of about 1,800 miles of street, roads and pavements located in an area of 129 square miles, and exclusive of the roads in Fairmount Park which are in charge of the park authorities.

The annual budget of the bureau in normal years varies from about $5,000,000 to $7,000,000 but on account of war conditions that delayed non-essential construction, as well as the great difficulty in securing men and materials and the increased cost of labor and materials especially during the last two years, both new construction and repairs had been reduced to a minimum, increasing the large amount of urgent work that is now in progress.

The jobs under contract July 31st, numbered 213, these including 151 different contracts in active operation, 15 of which were of large proportion. For new paving the city will spend about $500,000, besides $5,000,000 worth that will be assessed directly on the property owners. The average cost amounts to about $60,000 per mile. About $1,000,000 will be expended for repairs to asphalt pavements, about $1,000,000 for repairs to other pavements, about $500,000 for grading, $200,000 for country road improvements, salaries and overhead. Besides the money raised by assessments, direct taxation, and that available from the city treasury, an additional fund of $1,500,000 has been provided by a special bond issue so as to be immediately available.

The street program embraces all of the roads in Philadelphia county, excepting those in Fairmount Park but including those in League Island Park and the Roosevelt Boulevard eight miles long which forms part of the Lincoln Highway

TYPES OF CONSTRUCTION

In the outskirts of the city, in some of the residential districts, and in suburban quarters where the traffic is light, there are about 300 miles of waterbound macadam with treated surface and bituminous concrete. The width of this road is usually from 14 to 18 feet with curbs 30 feet apart, except in the localities where the traffic is greater and the paved width is increased to 20 feet. The full width of this road is oil-treated annually and sometimes oftener, except in some cases where conditions are such that a single treatment may suffice for two years.

About 50 per cent of all paving is asphalt surface, which is used under many different conditions, for almost all kinds of traffic, and for grades of less than 5 per cent. About 15 per cent of the pavements are of brick which is usually laid in residential sections, on narrow streets, or on excessive grades up to a maximum of 15 per cent where "Hillside" (a grooved brick) is used to diminish slipping. About 2 per cent of the pavement is wood block, which is used in the center of the city and adjacent to churches, schools and hospitals.

All of these types of pavements are laid on concrete base. About 15 per cent of the total mileage is paved with waterbound macadam and bituminous concrete having a minimum width of 16 feet and an average width of 20 feet, although in special cases the pavement often extends from curb to curb.

The balance of the paving in the city is of granite blocks, more than half of which are still supported on gravel foundations. It is planned to relay eight miles of granite this year, which in all cases is done with recut blocks. It is found that the old granite blocks, when removed from a given section of pavement and recut, will yield from 97 per cent to more than 100 per cent of the quantity required for the new paving. As the cutting is done rapidly, on the site, as the work progresses, it involves no delay and only a moderate cost, so that a saving of about $3 per square yard is effected without delay or trouble, and satisfactory pavement secured by its use.

ORGANIZATION AND CONSTRUCTION

The organization of the Highway Bureau includes chief of bureau, Fred C. Dunlap; principal assistant engineer in charge of construction, Chas F. Puff, Jr.; principal assistant engineer in charge of parkways and boulevards, Percy F. Proctor; division engineer in charge of bridge and sewer maintenance, J. C. McCormick, with a staff consisting of several clerks, engineer of permits and licenses, and six district engineers, each in charge of a separate district amounting to an average of about 300 miles of streets. Under these district engineers there are 25 assistant engineers and about 110 inspectors.

New paving, repaving, and important items of excavation or other construction are done exclusively by contract, but the city maintains a force of about 450 foremen and laborers for maintenance. This force operates from ten plant and supply yards conveniently located in different parts of the city, and at present is supplied with asphalt purchased ready mixed from a local company.

There is now under construction a $250,000 municipal asphalt plant which will be put in operation this fall with a capacity for 2,000 square yards of binder and surface course per day. At present asphalt repairs, both burning and cut-out, are made under contract ($1,000,000) supplemented by three municipal repair gangs of from ten to fifteen men each. The amount of work that is accomplished varies greatly with changing conditions, but may perhaps average 250 square yards per eight-hour day, with a maximum of about 400 yards per day.

ROOSEVELT BOULEVARD

The Roosevelt Boulevard, which forms an eight-mile section of the great national Lincoln Highway, is 300 feet wide with six rows of shade trees of many different varieties planted in the parking strips between the separate roadways. The center roadway, for pleasure traffic, is paved with asphalt 32 feet wide with a 2-foot gutter on each side. The two truck roads 34 feet wide have Topeka pavements with brick gutters on each side. In some cases the shoulders are of macadam temporarily provided to allow for future replacement with Filbertine or Topeka surface.

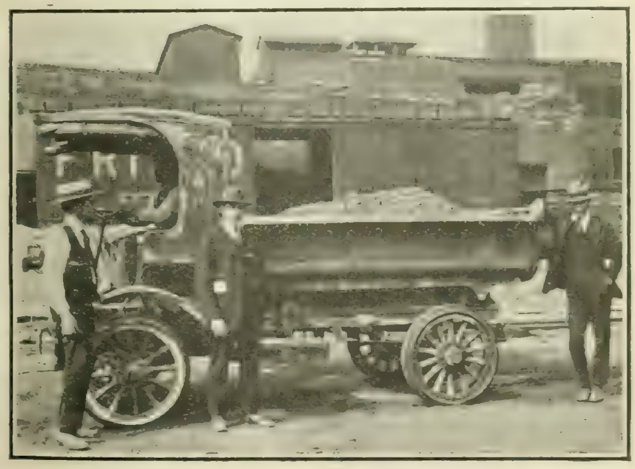
An important structure on Holme avenue, one of the three branches of the Roosevelt Boulevard, is the bridge built on the site of the burial ground of Thos. Holme. It serves as a memorial to a pioneer Philadelphian who was notably loyal and efficient in the development of the city's street system. This bridge is of concrete arch construction, of massive and dignified design, relieved with pebble finish, and has one 90-foot highway span and one 40-foot span aver the railroad tracks, supported on concrete piers and abutments terminating with curved wing walls. The total cost of the bridge is about $200,000 and the cost of the boulevard to date is about $4,000,000, exclusive of land damages. It was commenced in 1903 and it is expected will be completed to Welsh road in 1920.

TRANSPORTING CONCRETE FROM CENTRAL MIXER PLANT TO DISTANT PAVING JOB

LEAGUE ISLAND PARK

The League Island Park, with an area of about 350 acres, is improved by grading, planting, lakes, drives, walks and buildings constructed by the Bureau of Highways.

The first contract for grading, seeding, roads, walks and five bridges was awarded in 1914 for the sum of $490,000. The second contract for



DELIVERING AGGREGATE TO CENTRAL MIXING PLANT planting amounted to $40,000, and the bureau is now spending about $300,000 for boat houses, comfort stations, superintendent's quarters, and other buildings. In East League Island Park the bureau is also doing grading, planting, building walks and making other improvements to the amount of about $290,000.

CENTRAL CONCRETE PLANT

The central concrete plant installed by the Union Paving Co. and operated by it under the direction of the city with special supervision by Mr. Puff, was established in 1920 with a view to the elmination of possible difficulties and to its perfection to a degree that it was hoped would justify the subsequent establishment of one or more additional similar plants in other parts of the city, which it is now anticipated will soon be put in service.

It is located on the Schuylkill river and adjacent to the tracks of the Baltimore & Ohio main line, with connections to both the Pennsylvania and Philadelphia & Reading railroads, providing for delivery of materials by at least one transport line should the others be obstructed. It has a wharfage for six 500-yard scows that deliver sand, gravel, slag and broken stone, which are unloaded by a locomotive crane with clam shell bucket that deposits the materials in storage piles of about 6,000 yards capacity located on both sides of a standard gauge track running around three sides of the yard.

Asphalt sand is unloaded from scows by a stiff-leg derrick that also serves an elevated loading hopper which delivers to trucks below. Crushed slag also is received and handled like the broken stone and sand. Broken stone and cement are also delivered in railroad cars and the cement stored in a shed of 10,000 bags capacity.

The concrete plant is located in a 20 x 20-foot wooden tower 30 feet high, having in the upper part a 50-yard hopper-bottom storage bin divided into two portions. This bin is filled with sand and gravel or broken stone by the locomotive crane and discharges by gravity into the charging hopper of the Milwaukee mixing machine installed on the mixing floor about 16 feet above the surface of the roadway which passes under it through the tower. Cement bags are stored on the charging platform above the mixer and the two-bag batches of concrete, each containing 3 per cent of hydrated lime, are successively discharged into a loading hopper in the lower part of the tower which has a capacity for three batches, which together make a truck load that is delivered through a horizontal gate operated by a hand lever controlled by the driver of the automobile truck that hauls the concrete a maximum distance of five miles or more to the point where it is used.

This mixing plant is operated with a force consisting of one foreman, one engine-man, three laborers at the mixer, one yard-man, and one man in the cement house. The average production when working continuously is 1,500 square yards of base course in ten hours.

The concrete is mixed very dry so that a smooth surface can be secured by a hard blow with a shovel. After loading into the truck, which is previously sprayed with crude oil to prevent adhesion, it is well covered by a tarpaulin and is transported at an average speed, through ordinary traffic, of about twelve miles per hour, so that it reaches the point of disposal within thirty minutes after it is mixed.

The concrete is hauled in 2-ton trucks with elevating dump mechanism. From ten to twelve trucks are ordinarily kept in this service by the Union Paving Co., which operates this plant. A careful system of inspection records and time checks is maintained to insure the proper mixing of the concrete and prevent delay in its transportation. Very little trouble is experienced in delivering the concrete to the work within the required time and although the specifications are rigidly enforced it has very seldom been necessary to reject concrete because of poor quality or delayed deliverey.

Washington's Highways Laws

A thirty million dollar good roads bond issue, known officially as Referendum No. 1, presents to the state of Washington the possibility of placing its road building program on a modern business basis. Under the existing law the legislature appropriates money for work in the counties from which the money comes, which means a multiplicity of small jobs divided among the thirty-nine counties, each carrying its own overhead and resulting in increased cost. The proposed law would make it possible for the state to let the work in large units and more attractive to well organized contractors.

Sixty Million For Missouri Roads

Good roads advocates in Missouri are endeavoring to interest the citizens in good roads to the point of issuing $60,000,000 in bonds for that purpose. It is reported that there is no organized effort to defeat the bond issue, the only argument against it being that more than $20,000,000 was voted last year by the various counties and road districts for this purpose but no improvement in the highways seems to have resulted; which is answered by reference to the difficulties that all states have found in getting road work done this year.

Road Material Transportation Improving

Thomas H. McDonald, chief of the U. S. Bureau of Public Roads, announces that assistance is being rendered by that bureau in handling requests to the American Railroad Association for cars to be used for transportation of materials for road maintenance and construction work. He specifies the steps necessary for securing cars and states that the Interstate Commerce Commission desires co-operation between shippers and local railroad officials to settle transportation problems without action from Washington. Returning coal cars are now being routed so as to utilize them for handling road materials without interfering with priority for coal service.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

Erecting 30 - foot Bridge Girders Without a Derrick

THE PROBLEM

A roadbuilding contract consists almost entirely of light grading, draining and concrete pavement for which the contractor has proper equipment. But the road crosses over a railroad and highways that are to be spanned by two plate girders 30 feet long and 24 inches deep that weigh about 5,000 pounds each and are to be set 16 or 18 feet above the railroad track or highway below which must not be obstructed. The girders will be delivered at grade at the abutment by motor trucks.

The contractor wishes to erect them himself to save the heavy expense of sub-contracting to a steel erector. He has no plant except ordinary roadbuilding equipment, and cannot easily rent a derrick, tackles, or other special apparatus for handling these heavy girders. Is there any way by which he can economically put them in position without buying or renting heavy or expensive apparatus?

THE ANSWER

There are several ways in which these girders can readily be put in position on the abutments. Probably the easiest is by the protrusion method with rollers and a pilot beam, where the girders are simply pushed across from one side to the other, requiring only three or four rollers, a couple of long and heavy planks, a few bolts and a level space 40 feet long adjacent to one abutment.

In the line of the permanent position of one of the girders, on the level space at the abutment where the girders are delivered, set two fixed or "jack" rollers A and B, 14 feet and 24 feet respectively from the face of the abutment, and place one of the girders on them with the web vertical and the lower flange bearing on the rollers as shown in the diagram. The rear end of the girder should be supported by any convenient roller C.

Take two 12-inch pilot timbers or planks 20 feet or more long and 3 inches or more in thickness, place one on each side of the girder web, overlapping it 3½ feet or more, and projecting 16½ feet beyond in a horizontal position. Bore ¾-inch holes through these timbers 2 feet apart on the center line, one of them 6 inches from the forward end, and another hole close to the end of the plate girder. Drive a ¾-inch bolt through each hole, put a large washer on each end of each bolt, and screw the nuts up as tightly as possible without stripping the threads.

Have the lower edges of the pilot timbers in perfect contact with the upper side of the bottom flange of the girder, and fill in all the space between the top edges of the timbers and the top flange of the girder and next the web, with solid wood packing very tightly wedged in place and having perfect bearing throughout. Have the packing 3½ feet in length and clamp it and the ends of the pilot timbers to the girders by three yokes each made of two 6 x 8-inch or larger vertical pieces 3 feet long with two ¾-inch bolts through each end. These clamps must be fitted accurately to good bearing throughout on the timber and packing and must clear the girder flanges. The bolts must be screwed up as tight as possible on washers at each end.

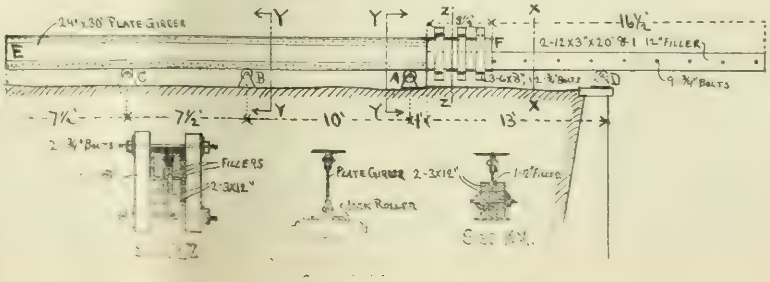
The two bolts at the forward end of the pilot timbers should have a nut at each end, and no heads, and should project 6 inches beyond the nuts at each end. A strong Manila hauling line should be attached to them, led to the opposite abutment and well snubbed around a tree or some other secure anchorage.

When all is in readiness, the girder should be launched forward on its rollers for a distance of about 13½ feet when roller B should be shifted to position D.

Roller C should be temporarily removed and a little pig-iron, stones, sand or other heavy ballast firmly secured to the end of the rear end of the girder at E if necessary in order to make it over-balance the forward end around the roller B as a pivot.

The roller C should be replaced and the girder pushed or pulled forward about 13½ feet, care being taken to pull in the hauling line slack and hold it securely as the girder advances.

Roller B should then be removed and placed in new position D on the abutment and roller C shifted to a corresponding position on the opposite abutment.



GIRDER WITH PILOT BEAM EXTENSION, ON ROLLERS, READY TO LAUNCH

The girder is then advanced until the front end of the pilot beam takes bearing on the roller C on the farther abutment, great care being taken to keep the hauling line taut and the slack snubbed securely until this bearing is accomplished.

Continue moving the girder forward until it is in exactly the required position, then bear down on the forward extremity of the pilot beam and lift up with a lever on the rear end E of the girder, thus releasing the roller D. Lower the girder to final bearing on its seat at D then with a lever, lift the forward end of the pilot beam, remove roller C and lower the girder to position on abutment there, remove the pilot beam, clamps and rollers, and repeat the operation for the other girder. The rollers, pilot beam, bolts and rope will be uninjured and ready for any other service. If plugs are driven tightly through the bolt holes in the pilot timbers, the strength of the latter will be scarcely impaired.

An Extensive County Road Building Equipment

In Crittenden County, Arkansas, the road projects totalling about $3,000,000 and including 50 miles of concrete and 115 miles of gravel roads are being built for four districts that have invested about $5,000,000 in railroad and construction equipment which includes one item of one hundred and five 80,000-pounds open top automatic steel dump cars purchased from the Western Wheel Scraper Company for about $300,000. Gravel pits have been opened in Missouri and Arkansas, each of which are expected to furnish daily a solid trainload of gravel cars that will be run to full-length sidings at five different places where the gravel will be unloaded by some of the ten locomotive cranes that will place it in storage piles, and reclaim it for the 40 motor trucks that will distribute it on the work.

Wilmington's Municipal Paving Plant

Wilmington, Delaware, has joined the considerable number of cities which operate municipal paving plants, having now under construction such a plant on Brandywine Creek, on the outskirts of that city. The plant was designed by Alfred S. Hirzel, engineer in charge of constructing of the Street and Sewer Department. The property has a frontage of 20 feet on the creek, 220 feet at the rear and is 366 feet dep. A dock is being built along the creek at which sand, stone and gravel can be unloaded from barges. Also, a switch from the line of the Pennsylvania railroad runs to the plant. The building for housing the asphalt plant has been completed and it is proposed to erect storehouses, equipment houses, two 10,000 gallon tanks for holding asphalt and oil, and an office building. The asphalt mixing plant has been installed by Warren Brothers and is supplying the asphalt material used by the city, but the asphalt is purchased in barrels rather than tank cars, as the storage tanks have not yet been constructed. The mixture now being used is 850 pounds of cement, 105 pounds of asphalt and 50 pounds of limestone dust. The remaining portion of the plant, especially the building of the dock wall and filling in behind it, will be done from time to time as the regular employees of the street department can be spared for this purpose.

Philadelphia and Bonding Company Disagree

A few weeks ago the director of public works of Philadelphia announced that he would refuse to approve contracts, the bonds submitted in connection with which were those of a certain surety company, until that company had adjusted satisfactorily to the city a contract of over $1,000,000 for a sewage disposal plant. This contract had been abandoned by the contractor, who had been bonded by the surety company in question for more than $500,000. Temporarily at least this necessitates contractors obtaining bondsmen other than the one with which the city is having this disagreement, and it is stated that a number of contractors who have recently received awards from the department have been required to change their bondsmen.

Ohio Gives Priority To Road Materials

On August 18, the State Utilities Commission of Ohio ordered all railroads in that state to give priority to road-making materials and supplies and to immediately assign cars for filling orders for such materials. This action was taken at the request of the State Highway Department, which declared that the construction of new roads and maintenance of old had been but 50 per cent of what was needed because of the failure to secure transportation of materials. Highway commissioner Taylor is reported to have estimated that the state would have spent more than $1,000,000 on roads by the middle of August had the materials and the machinery been available.

Serious Accident To Water Works Men

Five men prominent in various departments of the water works field met with an accident on August 19, when the steering gear of a touring car in which they were riding broke when they were near Selkirk, Ontario.

Arthur P. O'Leary chief of the Bureau of Records of Rochester, N. Y., was killed, and Leon S. Barnard of Buffalo, manager of the Hersey Manufacturing Co. and a member of the Buffalo Chamber of Commerce, was seriously injured and died a few days later in the hospital in Dunnville, Ontario. C. R. Wood, of the R. D. Wood Company of Philadelphia, was seriously injured also. G. C. Andrews, commissioner of the Bureau of Water of Buffalo, and B. G. Little, superintendent of water works of Rochester, were in the car but were uninjured.

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Everyday Construction Problems

In this issue, Public Works opens a department for furnishing practical information about construction work, explaining both special and ordinary operations and facilities, and suggesting suitable methods and plans to contractors who may encounter something out of their ordinary field or who may not be familiar with some particulars of usual practice or latest developments.

No matter how experienced or well-informed he is, it is impossible for any contractor to know all about all kinds of construction. He may be very competent and well posted in one or in several general kinds of work, but even in them there will be some things that he is not familiar with; and outside of these lines there will be many, the special features or even ordinary practice of which he has had no occasion to investigate.

The contractor with large resources and a technical organization can analyze, experiment and design for himself in such cases if time and opportunity afford. An inexperienced contractor, one with limited resources, in an isolated locality, or who is suddenly confronted with some problem quite different from his ordinary routine, may not be able to find the solution readily or may adopt an unsatisfactory one that may cost him unnecessary time and money. He would often be greatly assisted by prompt and reliable information concerning safe, simple, and economical methods of doing work with which he is unfamiliar, although many of them may be well established. It implies no discredit to any contractor to be unfamiliar with work outside of his usual sphere even if it is commonplace to those who specialize in it.

In this country competition has subdivided construction so much that specialists have been developed in almost every field; large varieties of plant and equipment have been provided; and all kinds of services and most types of construction, together with methods and operations of execution, have been more or less standardized. Ordinary questions relating to the execution of the work and even to its design and financing can, therefore, readily be answered in a general way by experts so as to give information suited to the problem or easily modified to cover it. Sometimes apparently simple questions involve considerations and other questions that appear difficult to the inexperienced have solutions that are obvious to those that have previously encountered them.

Although the editors of Public Works have not recently been in charge of actual construction and are not qualified as contractors or superintendents, it has been their privilege for many years to occupy the field of important and widely diversified construction, and to maintain confidential relations with many engineers and contractors and thus have up-to-date familiarity with the difficulties and requirements of many kinds of work and with the methods, plants and operations involved. They also have access to great technical libraries and opportunities for conference with specialists and experienced contractors in almost every field, enabling them to prepare or secure reliable conservative replies to most questions likely to be asked. These questions are cordially invited in order that we may benefit contractors; and on the other hand, notes, memorandums and photographs of separate features, no matter how subordinate, of difficult or interesting work are solicited from the same sources.

There is no limit to the field of inquiries we invite in this department so long as they are genuine and are accompanied by sufficient data of conditions and requirements. A few of the subjects that may perplex contractors that have not previously had experience with them are indicated by such questions as these:

What is a good system for loading, unloading, storing and handling aggregate for the large concrete job described herewith?

What is the best way to secure water and broken stone for this concrete road job?

How place concrete under water?

How best handle and erect a small quantity of heavy steel work?

How use oxy-acetylene flame for this wrecking or repair work?

How handle earth excavation in a deep trench?

How handle quicksand in excavation of the nature described?

How drive sheet piles and pull them for deep sewer trench?

How drive foundation piles in small headroom?

How apply given formulas?

How to build cofferdam on rock bottom?

How unload and transport very heavy units without special facilities?

The answers to such questions will indicate a rational application of standard practice and simple resources to the special conditions involved, such as can be properly undertaken by competent mechanics and superintendents, without solving problems whose importance or difficulty require the services of a consulting engineer or expert.

Unlimited Water For Dallas

The editor of one of the daily papers of Dallas, Texas, has recently given prominent expression to an opinion which is not as prevalent as it used to be but apparently still obtains in some quarters. This is that people should not be asked to economize in the use of water, but that it is very desirable to permit them to use all they want without any restraint such as meter rates or other pro rata charges.

The editorial in question says: "We should, instead of having need or occasion to urge the practice of economy in the use of water, encourage the use of it in quantities which, by test of the present per capita consumption, would be thought extravagantly large. Only so can Dallas become the city of great beauty that all of us should be ambitious to have it be. We should make water so cheap that few citizens would be under inducement to be sparing in the use of it. But this can be done, of course, only by making the supply superabundant. It might be necessary, as a means of bringing about that large use of water, to incur a financial deficit in the water department. That would sin against the supposed virtue of making the water department pay its way. But that, in our view, is only a spurius virtue."

Of course, if the people with open eyes decide to provide a superabundant supply with full knowledge of the great increase in taxes or water rates or both which it will cost them, there can be no objection to their doing so unless such extravagent use of water deprives other municipalities of water which they are in real need of. It is not often, however, that the taxpayers of a city the size of Dallas are willing to spend one million, two million or five million dollars for the privilege of having all the water they can possibly waste as well as use.

Municipal Bonds In July

The total sales of municipal bonds in July are reported by the *Daily Bond Buyer* to have been $50,717,202, which is slightly less than the sales for June, and only about two-thirds of the sales for July, 1919. However, the sale of municipal bonds for the first seven months of 1920, $412,324,045, considerably exceeded the sales for the corresponding period of 1919, which were $387,537,802.

The serious falling off in the sale of municipal bonds during the last few months has been caused by a slump in the bond market. During this period hundreds of issues have been found unmarketable. The largest cities of the country are now compelled to issue 5½ per cent or 6 per cent bonds to meet the market rates on loans and many municipalities either have been unwilling to pay such a rate or have not been permitted by law to do so. Had the bond market been as favorable as it was last year, the sale of municipal and state bonds this year would in all probability have reached the billion dollar mark. The largest individual loans during July included $4,000,000 by the state of Pennsylvania, $2,475,000 by Dallas, Texas, $1,170,000 by Columbus, $1,165,000 by San Francisco, and $750,000 by Cleveland Heights.

Decatur's Temporary Dam

The city of Decatur a few days ago completed a temporary dam which cost about $40,000 and which will store a supply of water probably sufficient to relieve the present shortage. A permanent dam is to be constructed which will raise the water more than 7 feet higher and thus greatly increase the amount of storage. When the permanent dam has been completed it is contemplated that the one just finished will be removed, although it would probably last a generation if necessary.

Water Filtration Experiments and Devices

In studying the purification of Lake Michigan water, Mr. Ellms experimented with mixing channels, fish ladder, "flume" and "fall," and concluded that coagulation could be effected more cheaply and just as effectively by one of the smaller devices as by a large coagulation basin. The devices and results are described below.

In connection with the experiments conducted by Jos. W. Ellms for the commissioner of public works of Milwaukee upon the best method of treating the water of Lake Michigan in order to make it more suitable for consumption (a general description of which was published in the August 21 and 28 issues of PUBLIC WORKS), a number of devices and methods were tried out, chiefly in connection with the mixing of the chemicals with the water and sedimentation preliminary to filtration. From the report of the experiments, which extended over practically a year, we have abstracted the following descriptions of the more interesting and important of the experimental features.

COAGULATION

Four new devices were tried for securing coagulation, as described in the previous issues named above. These devices were given the names of "fall," flume, fish ladder, and mixing channels. The poorest mixing action was obtained with the "fall." Somewhat better results were obtained with the fish ladder. With the "flume" an excellent mixing action was produced at a comparatively low velocity of flow, but the loss of head was considered too great. By cutting the flume into two parts and attaching the box known as the "fall," the loss of head was cut down about 25 per cent and good results were obtained.

Finally by removing the weirs from the flume, extending it slightly into the receiving box or "fall," and placing a low weir at the end, a hydraulic jump was produced by the rapid flow of water down the flume. The impact of water flowing down the flume into the pool back of the weir produced a turbulent condition of the water which effectively mixed the chemical solutions and the water. Considerable air is trapped in the jump and its escape contributes materially to the turbulent condition of the water and consequently improves the mixing action.

"The results with this device have been very satisfactory, and the reason for it requires explanation. When a precipitate is the product of a chemical reaction, it first appears in a very finely divided condition. In the case of a colloidal precipitate such as ferric hydroxide or aluminum hydroxide (the two compounds utilized in water purification), the aggregation of these particles into larger masses is necessary, not only to entrap the fine sediment and minute bacteria in the water, but to prevent them from passing through the sand bed of the filters. It is obvious that violent and continued agitation of the water will hinder rather than assist in this clotting together of these particles, and hence, to aid this coagulation, a quiescent condition is necessary.

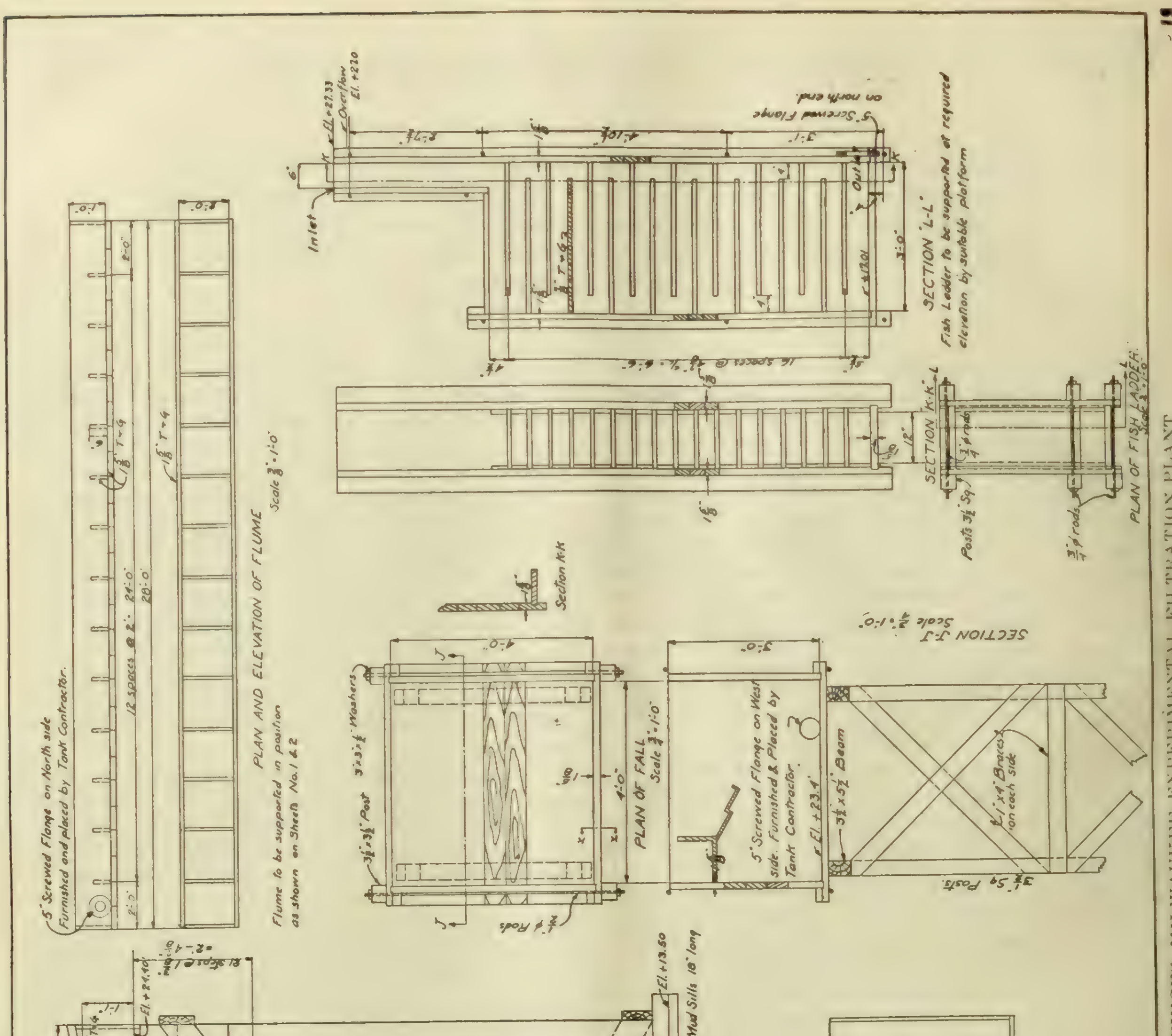
"The hydraulic jump mixing device provides an extremely rapid and thorough mechanical mixing of the chemical solution and the water to be treated, thereby bringing the reacting substances together and hastening the reaction. Immediately following the jump, the water flows quietly to a settling basin in which the physical action of coagulation can take place with the least possible amount of agitation, and thereby reduces to a minimum the breaking up of the floc during its formation."

In addition to these devices, experiments were made with the mixing chamber. It was found that prompt coagulation took place in the first five or six channels, but that the size of the floc decreased as the water passed through the remaining channels. In order to see whether reduction in size of the flocculated particles was due merely to flow through the straight channels or was caused by the agitation of the water as it passed around the ends of the baffles, the channels were blocked about 18.9 feet from the end and new openings cut through the baffle walls, thus giving the same number of reversals of flow but cutting down the length of each channel from 60 feet to 18.9 feet. Although nearly 70 per cent of the length of the chamber was thus cut out of service, the results were as satisfactory as before, but not more so.

SEDIMENTATION

The settling tank was 40 feet long, and 18 feet 6 inches wide and 9 feet deep. It was divided into four equal sections or passageways by three baffle walls. There was an influent flume at one end and an effluent flume at the other. In the last passage a third flume connected the influent and effluent flumes. The length of travel of the water along the center line of the passageways was about 175 feet. By use of weir planks and stop planks it was possible to use one or more of the passageways and thereby obtain different periods of sedimentation.

The theoretical displacement period, with a rate of flow of 125,000 gallons per day, was 7.5 hours and the lineal velocity 0.33 foot per minute. Float observations were made to determine actual lineal velocities and an average of six of these


PLAN AND ELEVATION OF FLUME
Scale 3/8"=1'-0"
5" Screwed Flange on North side Furnished and placed by Tank Contractor.
Flume to be supported in position as shown on Sheets No. 1 & 2
12 spaces @ 2' = 24'-0"
28'-0"
2'-0"
1'-0"
PLAN OF FALL
Scale 3/4"=1'-0"
4'-0"
3½"x3½" Post
3"x3"x¼" Washers
¾"φ Rods
Section K-K
SECTION J-J
Scale 3/4"=1'-0"
3'-0"
5" Screwed Flange on West side. Furnished & Placed by Tank Contractor
El +23.4
3½"x5½" Beam
2"x4" Braces on each side
3½" Sq. Posts
Inlet
Overflow El. +22.0
El +27.33
5" Screwed Flange on north end.
Out
SECTION 'L-L'
Fish Ladder to be supported at required elevation by suitable platform
SECTION K-K
Posts 3½" Sq.
¾"φ rods
PLAN OF FISH LADDER
Scale 3/4"=1'-0"
ELEVATION OF NORTH END OF MIXING CHAMBER
Scale 3/4"=1'-0"
Typical Bent
Bents are 7'-6½"
4"x6" Post
2"x6"
4"x8" Sill
2"x12" Mud Sills 18' long
El +13.50
El +24.90
2"x6" Cleat on each side of Post
2"x6" Cross braces between alternate pairs of Bents.
1"x6" Cleats 6' ½
11'-9⅝"
El of flange +22.21
5'-8"
PLAN OF NORTH END OF MIXING CHAMBER
Scale 3/4"=1'-0"
5" W.I. Pipe
5" Screwed flanges on north end
Slides
Side
Screwed flanges and Slides on north end only
Rev. 3-1-1919 - 1-20-20

DETAILS OF MIXING DEVICES, MILWAUKEE EXPERIMENTAL FILTRATION PLANT gave 0.56 foot per minute, or about 70 per cent greater than the theoretical velocity. "While this result was not entirely unexpected on account of previous experience, still it was rather surprising in view of the shallow depth of the tank (8 or 9 feet) and the manner in which it was baffled. Evidently the surface water slides over the more slowly moving or even almost stagnant water near the bottom, and thus passes through the tank in a much shorter time than called for by complete displacement."

Even with average turbidities of only fifteen to twenty parts per million in the raw water, this tank gave a reduction of 67 per cent for a theoretical displacement period of 7.5 hours when using alum as a coagulant. The micro-organisms removed varied from 61.1 per cent to 84.6 per cent, reducing the average number from 596 in the lake water to 128 in the settling basin.

It has been found in several cases that increased turbidity aids coagulation, and on account of the small amount of natural sediment in the lake water and its low temperature it was thought possible that the coagulation of it might be improved in this way. An aluminous clay was obtained which readily disintegrated in water and this was applied to the lake water as it entered the mixing device, at which point also the coagulating chemical was applied. In this way the turbidity was increased from three parts per million to twenty-one. The results obtained were rather unsatisfactory. A larger floc was produced but there did not appear to be any improvement in the effluent from the filters. On the other hand, the filter sand was overloaded with clay, and this was not removed by washing, the effluents of the filters being slightly turbid at the beginning of a run or just after washing them.

Sulphate of alumina was used as a coagulant in thirty-two operation periods, and sulphate of iron with lime was used in thirteen. Good results could be obtained with either. Different amounts of each were tested out and in general it appeared that sixteen to twenty parts per million of either coagulant would be required to produce good results.

FILTRATION

Two filters were used in the investigation, one equipped with a common type of strainer system, namely, a perforated pipe manifold laid on the bottom of the tank. The other filter had a wooden grid strainer system consisting of 1 in. by 6 in. boards set on edge and spaced 1 inch apart. The under side of the grid was placed 6.5 in. above the bottom of the tank proper, thus providing a space under the strainer grid which was filled with filtered water. The peculiar features of this latter type of strainer consisted in the opening to the filter bed totaling practically 50 per cent of the area of the bed, while the opening in the perforated manifold totalled only 0.3 per cent of the area of the bed. Otherwise the two filters were constructed alike.

The wooden grid strainer gave good results, but it is believed that had there been available a wash water pressure capable of producing an upward velocity of 2 to 2.5 ft. per minute, the bed might have been "blown up," allowing the sand to work its way down through the gravel into the bottom of the filter below the grid. If high velocities through the gravel can be properly controlled by a sufficient depth and grading of the gravel, it is believed that this grid will furnish a comparatively cheap, simple and effective type of strainer. Further experiments for the purpose of establishing the correctness of this opinion would be necessary before this strainer system could be adopted safely for a large plant.

A portion of the sand for the filter was obtained from Red Wing, Minnesota, and the rest was local sand from the lake shore. The lake sand first employed was coarsened by washing in a specially designed washer. Later on the sand was selected so as to obtain as coarse material as possible and then was washed in the filter tank. This washing brought several inches of fine sand to the upper layers, where they were removed after each washing down to the point where the sand of the effective size desired was found.

It was thought probable that for the large municipal plant, lake sand could be used and washed in this way so as to obtain a size suitable for the filters. Laboratory investigations were made along these lines, and these indicated that a complete stratification or arrangement by sizes was effected by this method of washing, and that the most effective portion of the sand, the finest, was carried automatically to the point in the filter bed where it would do the most effective work. A bed so arranged by stratification also offers the least resistance to the flow of water through it during filtration.

The experimental filters were found to operate with much shorter periods of service between washings than is found possible in many plants because of minute plants in the water which formed a gelatinous mat over the surface of the sand, and accumulated so rapidly on account of the number present in the water that they greatly retarded the passage of the water through the bed. Working at the rate of 125 million gallons per acre per day, the average length of service of filter A was only 10.49 hours and that of filter B was 6.05 hours. The longest run of either filter was 20.27 hours and the shortest run was 4.55 hours. Microscopic examination of the water indicated that there were never less than 100 to 125 of these organisms in each cubic centimeter of water, and as they averaged .02 m.m. in diameter, in four hours there would be applied enough to form a continuous surface coating of these diatoms over the entire surface of the sand bed. These short service periods considerably reduced the efficiency of the plant. This condition was relieved by a practice known as "breaking the filters." This consists in closing the effluent valve of the filter and opening for about half a minute the wash water valve. The rising wash water breaks the surface of the sand bed, throwing the deposited matter into suspension or displacing it so that a fresh surface of sand is exposed through which the water may filter. After the wash water valve has been closed, the effluent valve is again opened and filtration resumed.

The breaking of a filter may usually be done to advantage twice between washing. Periods of service are lengthened from 200 to 300 per cent and the wash water percentages are proportionately diminished, since no wash water is really lost by the breaking process, although such as is used must be refiltered and repumped. Tables giving data collected during the tests show that a gain of 10 to 15 hours in the length of run and a reduction of 2.5 to 3 per cent in the wash water was effected by breaking.

As to the effect of breaking upon the quality of the water, the lower the rate of filtration, the finer the sand, the less the disturbance of the sand bed when broken, and the better the coagulation, the less will be the deterioration in the quality of the filtered water. But it is obvious that unless a sufficient disturbance of the bed is effected so as to reduce the friction head of the flow of water, it fails of its object entirely; hence the operator usually endeavors to produce only such a loosening of the filter bed as will re-establish the rate of flow with the least injury to the quality of the effluent.

Different periods of rest were tested and it was concluded that a rest period of several hours should intervene between the washing of the filter and starting it again, whenever this was possible. The practice of wasting the effluent from a filter for a short time after starting is now rarely employed but the common practice nowadays is to disinfect the filtered water continuously and thereby obviate the necessity for wasting any filtered water.

Rates of filtration were tried up to 175 million gallons per acre per day. While operation at the higher rates seems to have had little effect upon the number of bacteria in the effluent, the effect of insufficient amounts of chemical coagulant, especially quantities below 10 parts per million, was quite noticeable.

Protecting Purity of St. Louis' Water Supply

The water works of St. Louis has been reported upon quite favorably from the point of view of affording protection, as described in our issue of August 14, but, in spite of the purification plant which is perhaps as up-to-date in construction and as well managed as any in the country, there is room for improvement in the character of the water delivered from the point of view of purity. For the water after purification is delivered into open reservoirs and, as is quite common under such conditions, receives impurities from the air. One of them at least is so located as to receive more or less impurity of a possibly dangerous nature which is blown from a bridge nearby at a higher elevation. Commissioner Wall has annually for five years past recommended that these reservoirs be covered, but so far has been unable to obtain favorable action by the Board of Aldermen.

It certainly is difficult to understand why the aldermen should refuse for years to protect the purity of the water supply on which the health and safety of their citizens depend and to secure which they have expended for a filtration plant many times the cost of covering the reservoirs. In fact, the running expense of the filtration plant for one year would probably cover the cost of this protection.

New Orleans Water Works and Drainage Capacity Exceeded

New Orleans has for several years been approaching and now is actually facing a serious condition in connection with its water supply and its drainage, and the superintendent of the Sewerage and Water Board, George Earl, in his latest annual report which has just been issued, calls attention to the seriousness of the situation, as he has done in several previous reports.

At present water is brought to the pumping plant through a single 48-inch pipe and the capacity of this is frequently reached by the present service. A double main should be installed, both to increase capacity and as a precaution against accident. There is practically no water storage in the city, and any interruption of service in suction pipe, pumping plant or delivery system would be a very serious matter. Owing to the insufficient capacity, the pressure in the lower or central portion of the city would be greatly reduced in the case of a large fire.

Not only the quantity but also the quality of the supply is threatened. The nominal capacity of the purification plant is 40 million gallons daily. For five months in 1919 this plant purified this amount as an *average* for the entire season and was compelled to greatly exceed this rate for many days at a time, occasionally carrying loads for hours at a time at rates of over 60 million gallons a day. This, of course, means that the overworking of the plant threatens a lower efficiency of purification and that it should at once be increased 50 per cent in capacity.

New Orleans, being below the level of the Mississippi when it is in flood, can prevent the flooding of its streets only by the operation of its drainage canals and pumping plants. It has now 12,000 horsepower available for pumping, but during storms of considerable magnitude all of this power is not sufficient to operate all of the drainage pumps or remove the accumulating drainage flow rapidly enough. If one of the drainage pumps should ever break down during heavy rainfall it would be utterly impossible to prevent the flooding of the lower areas of the city, or to remove the flood water within a reasonable period.

In addition to this, there has not been sufficient funds for several years past to construct sewers and water mains as rapidly as the growth of the city demanded and there are now at least 50 miles of streets in which such mains should be laid. At present there is being served by the Water and Sewerage Board about 600 miles of streets and 410,000 population. It is estimated that by 1940 the service should be extended to 1,200 miles of streets, and this would require an average expenditure of at least $2,500,000 a year from now until 1940 in continuous extension and improvement work. The Sewerage and Water Board has never had over $450,000 a year for such development and it is, therefore, imperative that a change in policy be made at once, or else the city must cease to grow except by the addition of such character of improvements as will be content to exist without water supply, sewerage or drainage.

Designing Aqueduct of Winnipeg Water Works

By James H. Fuertes

In previous issues of PUBLIC WORKS we have given analysis of the conditions affecting the general design of the new water works of Winnipeg, Manitoba, and a description of the works designed to meet these conditions; this being part of a paper prepared by Mr. Fuertes for the American Water Works Association. In the same paper he described the process followed in designing the several aqueduct sections, which part of the paper (like the other, unusually thorough and informative) is given below.

ARCH DESIGNS

The design of the aqueduct sections was influenced by many considerations, among which the most important were:

1. Solidity of foundation.
2. Economy in the use of materials.
3. Weight and character of material suitable for backfilling over aqueduct.
4. Character and quality of the soil as to chemical characteristics, and amount of moisture.
5. Depth of penetration of frost in different soils.
6. Elevation of permanent ground water level relative to invert of aqueduct, as affecting the tendency to float and to change the form of the section after construction.
7. Practicable construction methods to secure the expedition of the work.
8. Range of temperature of the water.
9. Character of soil as to relative amounts of clay, silica and organic matter in its composition.

The problems of arch design and invert design were influenced by quite different factors. Any arch design, to be strong enough to resist cracking, must be provided with practically unyielding foundations; in the larger Winnipeg arches a deflection of the invert by so little as 1-40 inch would crack it, and then the spreading of the feet of the arch following the further flattening of the invert would crack the arch along the center of the roof. Making the arches twice or perhaps even three times the thickness required for rigid foundations would not have prevented arch cracks under uneven settlement of the footing of the arch. The principle was therefore adopted to design the arches on the assumption of rigid foundations, and secure these, or as near these as practicable under local conditions.

The form of the arch and thickness of the arch ring were based, in general, on a backfill load of 4 feet deep over the top of the arch weighing 100 pounds per cubic foot, the width of the backfill, on top, being in all cases equal to the width of the aqueduct inside, with a minimum of 8 feet and side slopes for embankments of 1 vertical on 1¾ horizontal. The concrete was assumed to weigh 140 pounds per cubic foot. The stress diagrams for the arches were determined from the above loads, the earth pressure directions varying gradually from vertical, at the top in the center, to a slope towards the aqueduct of 20 degrees from the vertical at the bottom of the aqueduct; the concrete weights acting vertically downward; the water pressure within the aqueduct, for various depths of flow, acting radially outward, normal to the aqueduct faces; and ground water pressures, when expected, acting normal to the outside surface and inward toward the aqueduct.

The limiting lines for the inside and outside faces of the arches were determined from these stress lines by so adjusting these that for all conditions of loading the resultant lines of force would fall within the middle third of the section. The satisfying of this condition provides that there can be no tension in any portion of the concrete section, and therefore no tendency toward cracking of the arch.

The stresses in the "B" section of the aqueduct, which was used for a little over 6¼ miles are shown in Figure 1.

Only under two conditions did there appear to be a necessity for reinforcing the arch, and these were under road and railroad crossings, and where the aqueduct crosses the Brokenhead slough, where the back-fill material was practically all vegetable matter weighing only about

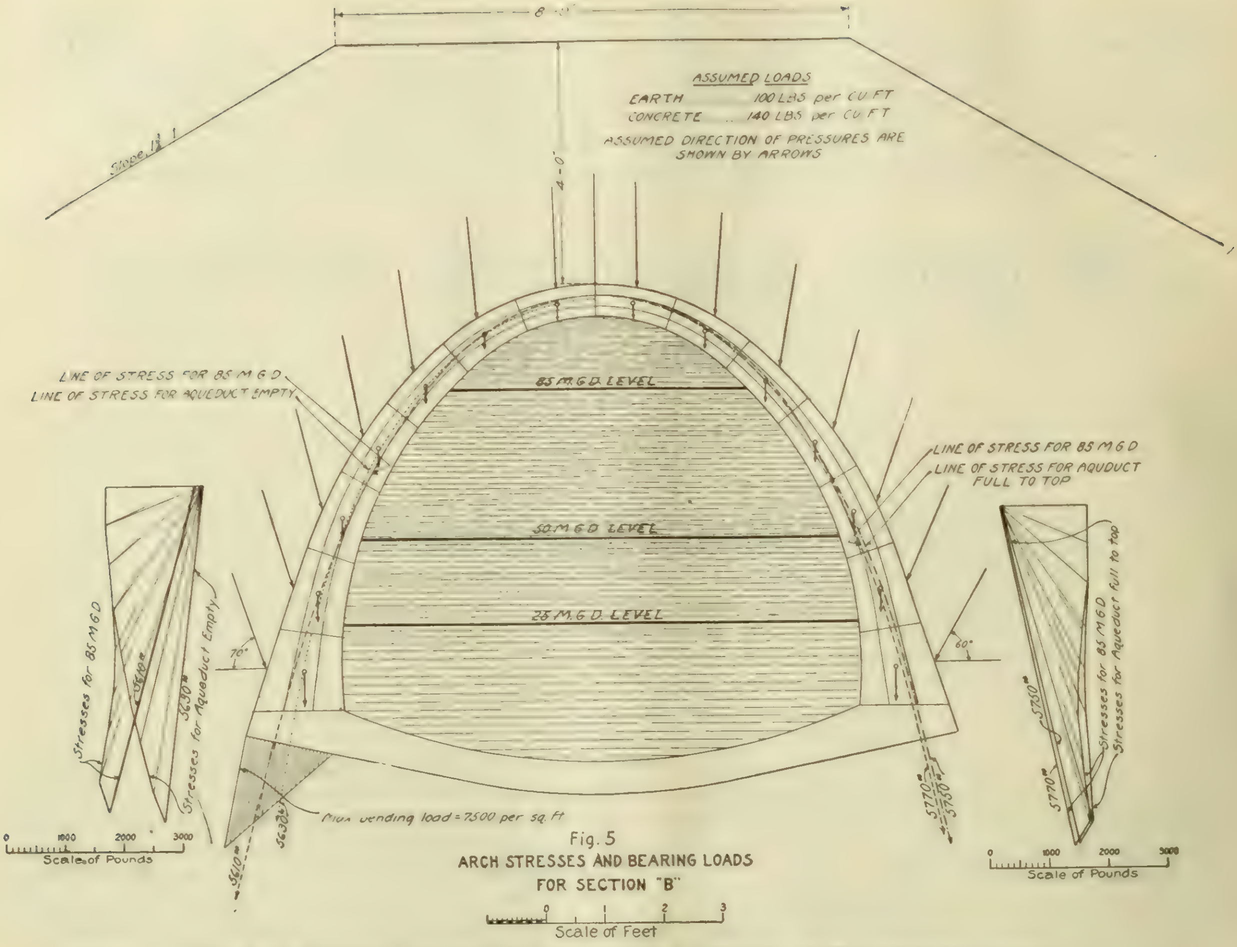

8'-0"
ASSUMED LOADS
EARTH 100 LBS per CU. FT
CONCRETE 140 LBS per CU. FT
ASSUMED DIRECTION OF PRESSURES ARE SHOWN BY ARROWS
Slope 1½ : 1
4'-0"
LINE OF STRESS FOR 85 M.G.D.
LINE OF STRESS FOR AQUEDUCT EMPTY
85 M.G.D. LEVEL
50 M.G.D. LEVEL
25 M.G.D. LEVEL
LINE OF STRESS FOR 85 M.G.D.
LINE OF STRESS FOR AQUDUCT FULL TO TOP
Stresses for 85 M.G.D.
5610#
5630#
Stresses for Aqueduct Empty
70°
60°
5750#
5770#
Stresses for 85 M.G.D.
Stresses for Aqueduct full to top
5770#
5750#
Max. bending load = 7500 per sq. ft.
5630#
5610#
0 1000 2000 3000
Scale of Pounds
0 1000 2000 3000
Scale of Pounds
Fig. 5
ARCH STRESSES AND BEARING LOADS FOR SECTION "B"
0 1 2 3
Scale of Feet

FIG. 1—B SECTION OF AQUEDUCT. ARCH STRESSES AND BEARING LOADS

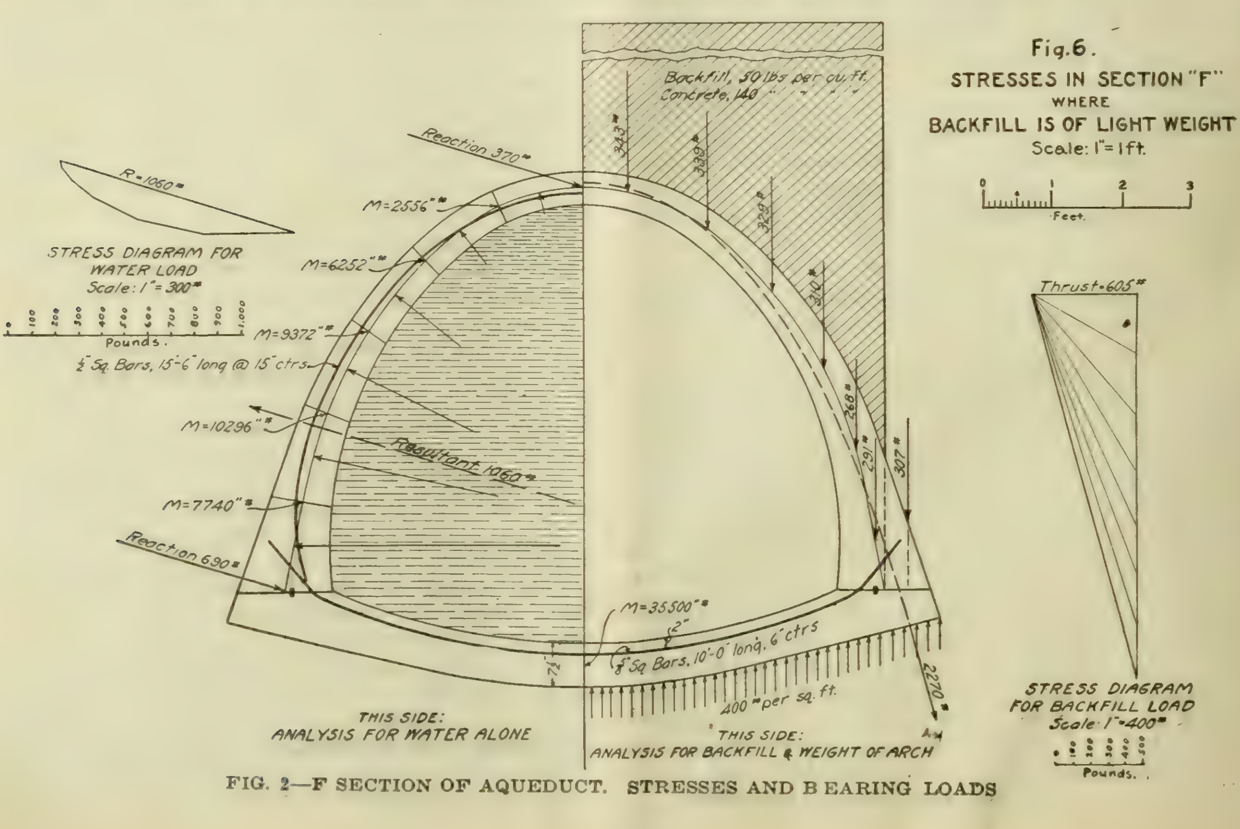


FIG. 2—F SECTION OF AQUEDUCT. STRESSES AND BEARING LOADS

50 pounds per cubic foot. The internal outward pressure of the water flowing through the aqueduct here would tend to produce deformation of the structure, or lifting of the arch off the invert; and reinforcing steel was necessary to tie the structure together as a unit and counteract the bending tendency in the sides of the arch. The stresses in this section are shown in Figure 2.

ACTION OF FROST

As to the possible depth of penetration of the frost in aqueduct embankments, or its action or effect, some rather surprising facts were noted during the winter of 1915-1916 in investigating this matter. In the prairie section, for instance, it was found in one place that where frost had gone down 4 feet on the prairie, it was of less depth on the top and side slopes of the embankment over the aqueduct, which was in a rather shallow cut at this point. On digging a trench crosswise of the aqueduct to examine the condition of the embankment, it was found that the linear expansion parallel to the surface of the side slopes and top of the embankment, due to the freezing of the clay soil, had caused the frozen back-fill to raise up, where passing over the arch, forming a cavity between the arch and the embankment (supposed to be resting on it). This cavity was about five feet wide across the aqueduct, tapering from nothing at the sides to over 6 inches high in the center over the arch. In another place where the aqueduct is in a 7-foot cut, the frost penetrated the prairie about 4 feet, the bottom of the frozen ground extending horizontally through the backfill and against the arch, where it had frozen fast to the concrete and produced strains, the effects of which were shown in the cracking of the arch on both sides and its being lifted vertically about ¼ inch. After frost left the ground the arch settled down again in place to its original position. The invert did not crack, the cracks in the side walls were parallel to and 3½ feet above the invert. These effects were produced, however, before the backfill had been entirely completed and while the aqueduct was empty, during a very cold winter. Practically no expense was necessitated for repairs.

TEMPERATURE IN AQUEDUCT

Taken as a whole, the depth of backfill chosen was sufficient but not too much. Continuous observations throughout the whole length of backfilled aqueduct during the cold winter referred to showed that the temperature of the air within the aqueduct, except in the immediate neighborhood of open manholes or connections, remained around 35 degrees to 37 degrees Fahrenheit until the advent of warm weather.

In most places frost did not petetrate to the arch until Spring, and then showed in a band of hoar frost of varying widths in different places, sometimes being only a foot or so and sometimes extending down to within a foot or two of the bottom of the arch on each side. The muskeg covering was quite efficient as frost protection, but required a covering of earth or gravel as protection against fire. Frost penetrated most deeply and most quickly through moist, densely consolidated clay; less deeply and more slowly through sand and gravel; and least extensively and most slowly in the muskeg covering after it had been in place for some time and had a chance to dry out somewhat.

ADEQUACY OF ARCH DESIGNS

The arches designed on the above assumptions have stood without defect or showing any sign of weakness. They are thin and were made so deliberately and after much thought and study. This was recognized in the estimates submitted in the report of Hering, Stearns and Fuertes, and was discussed extensively during the preparation of that report, the conclusion being reached that every justifiable economy should be practised in the building of these works. The difficulties of putting an aqueduct through 100 miles of wild country, largely swampy, with uncertain and unknown conditions as to foundations, were fully realized; and, on account of the great cost of the works for a young community grown and growing so rapidly and needing water to maintain its very existence, to have stood upon the principle of "no risk" in the designs would have rendered the project totally impossible, on account of the great cost involved.

It was known that settlement might be expected but that, the aqueduct being one through which the water would flow as in an open ditch without exerting pressure, there would be no difficulty and but little expense involved in making repairs. For practically the whole length, the bottom of the cut-and-cover aqueduct has been placed at such an elevation that the surface of the flowing water in the aqueduct may be kept lower than the natural ground surface until the consumption of water by the District shall have increased to or exceed about 50 million gallons per day, and an open ditch would have served the purpose of carrying the water from river crossing to river crossing all the way from Indian Bay to Mile 23. In fact, a scheme like this was suggested in 1883 by Dr. Agnew, who proposed conveying the water to Birds Hill and distributing it from there.

The cut-and-cover of the aqueduct, therefore, is to be considered in the light of a lining for a ditch, given an arched section in order to permit covering the ditch for the protection of the water from vegetation and dirt and from cold, and to permit making the ditch smaller by reason of the smooth walls and bottom provided by the concrete surfaces, on which the water would run faster than it would in a natural ditch through the open country.

PRESSURE SECTIONS

Only at the river and valley crossings is this aqueduct in any respect like a pipe line, and at all such places it has been given a circular form and contains enough steel bands to take all the bursting strains due to the water pressure and all the distortion strains due to the earth backfill, without straining the steel to more than 10,000 pounds per square inch in tension or the concrete to more than 500 pounds per square inch in compression. These low limits were fixed after much study of the extension of the steel under tension and the amount of extension the concrete, as made, would stand without showing hair-cracks. While it was not a matter of serious consequence whether cracks appear in the cut-and-cover sections of this aqueduct, as these could be repaired easily, it would have been fatal to allow cracking of the concrete containing steel reinforcement, as the steel would than be exposed to the action of the water and would in time be attacked. As rusted steel occupies more space than clean, dry steel, the exposure of the steel would result in the scaling of the concrete away from the steel and the ultimate rupture and destruction of that portion of the aqueduct. The stresses in both steel and concrete were limited, therefore, to amounts which experience gained by experimentally bursting reinforced concrete pipe lines by internal pressure showed to be well on the safe side of the danger limits, and, so far as known to date, these assumptions have proved sound in practice.

(*To Be Continued*)

Mexican Troubles and American Irrigation

Although a considerable part of the boundary between Mexico and the United States is a natural one—the Rio Grande river, the western half of the boundary is not so distinctly defined by any natural features. Even the stream which forms the extreme western boundary is merely a shallow creek bed which contains no water a large part of the year. Settlements along the boundary line, some of them straddling it, are accustomed to the inconveniences attending the battles and promiscuous shooting which occur just across the border, but few residents of this country except those immediately concerned realize some of the other inconveniences brought upon this country by the conflicts of authority or lack of authority existing in that unfortunate country.

One of the unspectacular effects to which we refer is in connection with irrigation in California just above the border. The Imperial Valley irrigation system is supplied by canals, the headgates of which are in Mexican territory, and many miles of canals cross that territory before reaching the boundary line. Military operations in this part of lower California, which is apparently to suffer in the immediate future from a conflict of authority between the governor and president, might easily destroy the headworks, in which case the farmers of the Imperial Valley would be deprived of irrigation water, which would mean the inevitable destruction of their crops. The United States government cannot maintain an armed force in Mexico to protect these headworks, and the contending armies, to which military considerations overshadow everything else, might easily complete the damage before diplomatic action through the Mexican governent could secure the needed protection.

Big Iowa Drainage Project

A drainage ditch 23 miles long, practically across Johnson county, Iowa, at a estimated cost of $270,000, is being considered by the Board of Supervisors of that county.

Immigration Notes

Number of arrivals increasing weekly. From some countries they are limited only by the transportation facilities.

2,000,000 Italian Immigrants Waiting

Representatives of twenty-one steamship companies have made statements to immigration commissioner F. A. Wallis indicating that for the next five years, the rate of immigration to this port will be limited only by the accommodations of passenger steamships.

The representative of one Italian line said that there have now been made in Italy alone, 2,000,000 applications for passports to America. An agent of the Hebrew Sheltering Society says that arrangements have been made to receive 1,000 Jewish immigrants a week for the next 52 weeks. Another steamship agent said that applications for passage already received are sufficient to fill up the booking completely for ten years.

It is predicted that the arrivals will soon reach 25,000 per week. This rate, if continuously maintained, would amount to more than one and a quarter millions yearly, which is probably in excess of the transportation now available.

The steamer Dante Alighieri, from Naples and Genoa, landed 2,000 passengers at the port of New York on August 22, all of whom were however detained for observation at Hoffman Island on account of a case of smallpox that had developed on board, although the passengers had been vaccinated before leaving Italy Aug. 8.

During the week ending August 21, there were reported 10,914 arrivals from Europe at the port of New York, but as the number included 1,800 cabin passengers, it leaves only 9,114 that are presumably in the working class, a number which, to give the real accession to the supply of workingmen, must be still farther reduced by the subtraction of about 1,000 Irish girls who form most of the list on the Celtic, besides the considerable portion of women and children in the other vessels.

The already large and often undesirable foreign Jewish element in this country is likely to be more and more rapidly increased by the flood of refugees that are seeking to enter America from the European war districts. They are reported to be coming from Poland to Danzig where they hope to embark for the United States at the rate of 250 families or a thousand persons daily. Other large groups of Jews have been reported frequently as arriving or on their way, and as they manifest a strong disposition to gather in large cities and do no generally afford efficient recruits to mechanical and construction operations or to agricultural pursuits, it would be well to have their arrival as strictly supervised as is that of the Asiatics on the western coast.

It is reported that the Brazilian government has just transported the first contingent of a lot of 2,500 German settlers, accompanied by professional men with credentials from the interial German Emigration Bureau, who are the first of a series of contingents of the Teutonic invasion of Brazil.

During the latter part of August, it was officially reported from Washington that the number of immigrants daily landing at Ellis Island had increased to 5,000 and that during the year ending June 30, 800,000 immigrants arrived in the United States as compared with 141,132 during the previous year. Although there is still great difficulty in securing transportation, which is inadequate, and trouble in leaving Central Europe, the number arriving is constantly increasing and all steamship accommodations for the next year have already been engaged.

According to statements from Winnipeg, Canada, 3,000,000 acres of land in western Canada have been purchased since the beginning of this year by about 100,000 American farmers, most of whom expect to settle upon it next spring. These purchasers brought into Canada more than $5,250,000 cash and other property valued at more than $1,700,000 and requiring nearly 400 railroad cars for its transportation.

Foreign Restriction of Immigration

In a bulletin issued by the Inter-Racial Council it is stated that: "The time has passed when the American employer could count upon an unlimited supply of labor from abroad. Emigration from the countries of Europe will be strictly regulated by the governments in the near future, and is already being directed in some of the Old World nations, which have begun to realize the value of their workers.

"This is the case in Italy, for instance, which has supplied us with such vast numbers of unskilled and semi-skilled laborers. The French Government has offered Italy six tons of coal per month for each Italian miner induced to go to France, and The Commissioner of Emigration of Italy is advising his people to emigrate to France. It is asserted that opportunities are better there than in America, both for steady work and high wages.

"Other countries are making efforts to keep their citizens at home. Greece is offering inducements of farms to the people, having passed an act by which large land owners may retain only one-third of their estates, while surrendering two-thirds to the peasants. If this offer should not be sufficiently persuasive, emigration from Greece may be prohibited at any time by law. Conditions in that country are being studied at present to determine what action may be necessary to prevent an undue exodus of the population. The extension of Greek territory is a powerful reason for keeping these people in their own country.

"Similar conditions are found in Finland, where areas have been set aside for settlement, and farm implements and supplies are offered to small cultivators on liberal terms.

"These instances show the attitude of foreign governments toward their nationals. Instead of permitting their men and women to leave at will and select their own destinations, as in our port, emigration will be curtailed, by many governments. . . .

"Some of the foreign nations are planning to do the things which America should have done long ago; to protect immigrants from fraud, to establish official information bureaus, to take care of their savings through branch banks and generally to look after their welfare.

"International agreements are being made between Old World countries regarding immigration. Diplomats of Hungary, Poland, Greece, Italy, France, Lithuania, Spain, Portugal and the Balkan countries have taken the lead in such conferences, but the United States, which has so much at stake in the matter, has shown indifference.

"We should not be deceived by the temporary increase in immigration. The figures that indicate a large number of arrivals at Ellis Island fail to show the fact that the proportion of women, children, professional and clerical workers is so great as to afford little relief to our labor shortage. Of the manual laborers coming in, a large percentage are men who went abroad to fight and are now returning to their old jobs. Of the new workers, to do the essential work of America, there is an exceedingly small percentage, while recent correspondence from all parts of the United States indicates serious shortage of labor in almost every section.

"The course of action for the employer is, therefore, first, to conserve labor as carefully as he conserves his raw material; second, to regard immigration problems with the same interest that he gives to international commerce, realizing that America is no longer isolated and that what happens in the Old World today, will be reflected in his own business tomorrow.

An international conference on immigration is planned for 1921, in which the United States should play a leading part. Business men who are interested may obtain further details through The Inter-racial Council, Woolworth Building, New York."

Municipal Railway Operation Voted Down

At a political primary on August 10 the citizens of Toledo, Ohio, voted down two proposals concerning the municipal operation of street cars by a majority of about three to two; these propositions involving the issuing of bonds for $3,000,000 in one case and $4,000,000 in another. At the same time the people voted in favor of an $11,000,000 bond issue for the city's schools. This was a decided set-back for those who had been advocating government ownership of the railways. It is reported that an ordinance will probably be submitted to the people providing for a service-at-cost operation of the railways.

San Francisco's Municipal Railways

News recently received from San Francisco states that the municipal railroad system is running behind at the rate of $130,000 to $140,000 a year on the car service payroll alone, with no additions to the sinking fund to take care of deterioration and general depreciation. The supervisors are said to be meeting the monthly deficits by drawing upon the present depreciation fund. It must be only a matter of time when this will have vanished, and the road will then have to come back on the taxpayers or else considerably increase the rates of fare in order not only to meet running expenses but to rehabilitate the depreciation fund.

The suggestion that the deficit could be greatly reduced if not wiped out by running one-man cars will not be adopted, it is believed, because the supervisors will not risk their political future by discharging a large percentage of the present employees. As to raising fares, it is urged that this would decrease the income rather than increase it, because the private company with which the municipal system has to compete would then attract a large part of the traffic by their lower fares.

The above figures are published with supporting details from the San Francisco Chronicle. On the other hand, however, the Board of Public Works states that the municipal railway is not running behind by any such amount but that the net deficit for the twelve months ending June 30, 1920, was approximately $16,000, based on a wage scale of $5 for an eight-hour day for platform men. According to the figures issued by the board, the net receipts for that year totalled $2,729,016 and the total expenses were $2,745,074. These expenditures include operating expenses of $1,996,389, bond interest $233,503, depreciation and accident insurance reserve $496,806, and other expenses of $18,376. Eighteen per cent of the gross passenger revenue is set aside for depreciation, redemption of bonds, renewals, accidents, insurance, reserve, etc., and also an amount sufficient for the protection of its employees.

Since December 28, 1912, the gross receipts have totalled $13,733,276 and the cost of operation has been $8,639,834, leaving as the excess of revenue over operating costs $5,093,442. Out of this excess it has paid interest on bonds and redeemed $800,000 worth of bonds and has built extensions costing nearly one and one-half million dollars and has to its credit in the treasury $1,180,187.

During the latest fiscal year it carried 66,169,246 passengers and operated 7,419,272 car-miles. There were filed 2,019 accidents, seven of which were fatal (only one of these to passengers), and 657 personal injuries. Of the 2,019 accidents, 1,231 were collisions with autos and wagons, 157 due to boarding a moving car, 126 to leaving a moving car, 112 to car collisions, and 393 miscellaneous. The total amount paid for accident claims was $19,017 for personal damages and $1,668 property damages, with $12,145 as cost of adjusting these claims.

California's Irrigation Act Illegal

A state irrigation act was passed in California in 1915 and amended in 1919 which provided for the formation of irrigation districts. Under this act five districts have been organized and nine applications are pending before the State Irrigation Board. The Supreme Court a few days ago declared that the act was illegal on account of its "lack of uniformity of operation," the act being so worded that it would not apply to any county which had adopted a county charter and there being only two such counties in the state.

This leaves the five irrigation districts as invalid and automatically discharges the members of the State Irrigation Board. According to a member of a California bond house, the decision in no way affects the outstanding bonds amounting to $25,000,000, since these were issued under a previous act and none have been issued under the act of 1915.

Enormous Colorado River Dam Proposed

Plans now under discussion for the irrigation of Imperial Valley, Calif., are being investigated with appropriations of more than $60,000 and borings are being made to explore the foundations for the proposed Boulder Canyon dam of a possible height of 600 feet and a storage capacity of 25,000,000 acre-feet to regulate the flood flow of the Colorado river and supply irrigation to all arid lands both in Mexico and the United States. The construction of the dam would also prevent flood damages and provide for the generation and distribution of an enormous amount of hydro-electric power.

Corrected Weight of Structural Steel

The association of American Steel Manufacturers announces a revision of the tables of standard weights of minimum sizes of I-beams and channels which will correct the slight differences for many years existing between the published weight and the dimensions of the standard cross-sections. There is no change in the profiles and properties of sections having minimum web thickness, and no change in the weights and properties of intermediate and maximum sections. The minimum weights are all slightly increased by amounts varying from 0.2 pound to 0.9 pound per foot for I-beams from 3 inches to 24 inches in depth, and varying from 0.1 pound to 0.9 pound per foot for channels from 3 inches to 15 inches in depth.

Recent Legal Decisions

APPORTIONMENT OF COST OF PAVING STREET

Texas Rev. St. 1911, art. 1009, authorizes payment for street paving wholly by the city or party by the abutting owners, but provides that the owners cannot be assessed for more than three-fourths of the cost. In an action by a paving contractor upon special assessment street paving certificates, the Texas Court of Civil Appeals holds, Sullivan v. Roach-Manigan Paving Co., 220 S. W. 44, that the three-fourths of the cost of paving a street which can be assessed against property owners under this statute is three-fourths of the entire cost of the paving, although a street car company was compelled by its franchise to pave part of the street. There was no doubt of the city's power to contract for the pavement of the entire street, even though it could have required the car company to pave part of it. (McNeill v. South Pasadena, 166 Cal. 143, 135 Pac. 32, 48 L. R. A. (U S.) 138.) The apportionment made in this case resulted to the advantage of the public and the property owners, as the company was required to pay for the portions described in the statute instead of a smaller area described in the franchise ordinance.

ROAD COMMISSIONERS, AUTHORIZED TO PURCHASE IMPLEMENTS, CAN LEASE THEM

Arkansas Acts 1915, No. 383, section 31, provides that a board of road improvement commissioners created under the statute may "purchase material and implements necessary to carry on the work of the improvement." The Arkansas Supreme Court holds, Galloway v. Road Improvement Dists., 220 S. W. 450, that the power to purchase includes the power to lease road building machinery. The word "purchase" is essentially applicable to the procurement of material, for that, when used, becomes a part of the roadbed; but implements and other equipment, which are not exhausted in the work of construction may be procured in other ways than by purchase. The authority to purchase being the greater of the powers to be exercised, necessarily includes the lesser power to lease or to accept as a donation.

EXTRA WORK ON ROAD CONSTRUCTION CONTRACT—UNAVOIDABLE DELAY

A road construction contract was let in accordance with a bid to furnish all material, tools and labor for a stated amount. The Arkansas Supreme Court holds, Osborne v. Luter, 220 S. W. 481, that on completion of the contract the contractor was entitled to the specified amount and nothing more, regardless of whether the work was under or over the engineer's original estimate, although the proposal to bidders provided for payment for actual work performed. The contract did not prevent the highway commissioners from having extra work done without materially altering the general plan of the improvement, and for performing such extra work the contractor was entitled to compensation. Under Arkansas Acts 1915, No. 338,016, road commissioners are not required, in order to have such extra work done by the contractor, to revise the plans and give the landowners notice thereof. This section applies only when some material alteration of plans or specifications is proposed. A road contractor cannot recover for extras where he does not show that such work is not covered by the plans and specifications upon which his bid was proposed.

The contract provided that the work should be done within 150 working days, and that liquidated damages at $10 per day should be paid for all time in excess thereof consumed by the contractor. Delay resulted from causes beyond the contractor's control, and not within the contemplation of the parties, and 390 days were consumed in the construction. Damages, therefore, could not be charged to the contractor.

RIGHT OF ACTION OF LABORERS AND MATERIALMEN ON GOVERNMENT CONTRACTOR'S BOND—TIME LIMIT

The federal district court for the Western District of Kentucky held Belknap Hardware & Mfg. Co. v. Ohio River Contract Co., 264 Fed. 676, that the right given those who have furnished materials or labor to a government contractor to sue in the name of the United States on the contractor's bond, under act of Congress Feb. 24, 1905, is to be enforced by an action at law on the bond, not by a suit in equity. Under that statute an action by laborers and materialmen on the bond cannot be begun until the expiration of the six months after the completion of the work allowed for action by the United States on the bond for its own benefit, and must be brought within one year of such completion. This statute entirely supersedes that of Aug. 13, 1894, which did not fix any limitation of time for such a suit. After the time for suit has expired, there is no equity against the sureties on the bond in favor of laborers and materialmen which entitle the latter to preference in payment from a fund in the hands of the receiver of the contractor, as against creditors of the contractor who were also sureties on the bond, especially where the laborers and materialmen, by suing on the bond within the time required, could have collected their claims in full from a fund then in the hands of the receiver, so that the sureties could have been relieved of all liability.

CONTRACTOR SUING FOR SUBSTANIAL PERFORMANCE MUST SHOW COST OF WORK NOT DONE

Where an excavation contractor seeks to recover for substantial performance he must first show the cost of the work not performed.— Conforti v. Singhi, New York Appellate Division, 182 N. Y. Supp. 899.

NEWS OF THE SOCIETIES

September 13-16—PACIFIC COAST ASSOCIATION OF FIRE CHIEFS. Annual convention Los Angeles, Cal. Secretary, H. W. Bringhurst, Seattle, Wash.

September 13-17—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual meeting San Francisco, Cal. Secretary, A. W. Hedrich, 169 Massachusetts Ave., Boston, Mass.

Sept. 16-18.—ENGINEERING INSTITUTE OF CANADA. Meeting to be held at Niagara Falls, Ontario.

Sept. 20-23 — SOUTHWESTERN WATER WORKS ASSOCIATION, Annual convention, St. Charles Hotel, New Orleans, La. Secretary, E. L. Fulkerson, Waco, Texas.

Sept. 27-Oct. 21—NATIONAL SAFETY COUNCIL. Ninth annual safety congress at Milwaukee. W. H. Frater, treasurer and business manager, 168 North Michigan avenue, Chicago.

Oct. 12-14—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. St. Louis, 401 Lincoln Avenue, Valparaiso, Ind.

October 13-15—AMERICAN CIVIC ASSOCIATION. Annual convention Amherst, Mass. Secretary, E. F. Marshall, Union Trust Bldg., Washington, D. C.

October 16-19—AMERICAN COUNTRY LIFE ASSOCIATION. Annual conference Springfield, Mass. President, Kenyon L. Butterfield, Amherst, Mass.

Oct. 19-22—INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. 25th annual convention, New Orleans, La. Secretary, C. R. George, Houston, Texas.

Dec. 7-10 — AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual meeting. New York Secretary, 29 W. 39th St., New York City.

Jan. 25-27, 1921—THE AMERICAN WOOD PRESERVERS ASSOCIATION. Place of meeting to be announced later.

AMERICAN SOCIETY OF CIVIL ENGINEERS

At the annual convention of the American Society of Civil Engineers held in Portland, Oregon, August 10-12, the annual address of Pres. Arthur C. Davis, vigorously discussed "whether or not the society is to take its proper place among human activities or gradually decay and become an obstruction to progress, pretending to fill a niche which it does not fill, and wasting the prestige and history of this glorious society."

He severely criticised the minority in the American Society of Civil Engineers that was charged with opposing the co-ordination and co-operation of the founder societies. He did not consider the Engineering Council to be a satisfactory organization for producing practical results and recommended the substitution for it of a league of engineering societies. He was in favor of license laws of the centralization of federal engineering activities in a single department.

In the proceedings of the convention much prominence was given to 14 proposed constitutional amendments of which finally four were ordered to be sent to letter ballot as originally proposed, four were slightly revised and ordered to letter ballot, and six were referred to a committee of the Board of Direction for report at the annual meeting next January.

In accordance with the recent custom, the meetings of the convention were devoted to business purposes, and papers and lectures, which in former years had been presented, were not on this program. Time not devoted to business meetings was available for a variety of social pleasures, including a special automobile trip of about 400 members up the Columbia river, a smoker including members of the Oregon Technical Council and of the American Association of Engineers, and a harbor trip visiting the municipal terminals, the Standifer steel shipyard at Vancouver, Wash., and the Interstate bridge.

AMERICAN ASSOCIATION OF ENGINEERS

The Twin City Chapter has arranged with the general extension division of the University of Minnesota to form evening classes in various subjects. The classes will be instructed by members of the faculty of the university and by the leaders in professional practice outside the university. Only twelve students in each class are required to inaugurate the work in that subject. Classes will be held at the university or at other locations to be selected later. Courses are offered in the following technical subjects: Architectural history, architectural design, freehand drawing, map drawing, surveying, railroad engineering, stuctural design, reinforced concrete, elementary electricity, direct and alternating current machinery, power plant design, shop mathematics, applied mechanics, heating and ventilating, water power, municipal engineering and highway engineering.

In addition to the technical subjects offered the following business and arts courses are also available: Art appreciation, English, modern language, history, political science, accounting, business law, banking practice, corporation finance, cost accounting, transportation, railway traffic and rates, business English and public speaking. Credit for the arrangements for the courses in the Twin Cities is due to Professor Frederic Bass, head of the department of Civil engineering in the University of Minnesota.

The Chicago Chapter, which held some very successful classes in public speaking and other subjects last year, announces plans for classes this year in public speaking, business organization and administration, scientific methods of testing and handling labor, engineering accountancy, and banking and finance.

The city and county of Honolulu is in urgent need of a comprehensive plan for an adequate supply of water as well as a complete sewer system. The mayor and the board of supervisors have gone on record as favoring a comprehensive program to be financed by a bond issue. The Honolulu Chapter of A. A. E. is endeavoring to bring about the appointment of a commission of three engineers to act in advisory and consulting capacity in cooperation with the city and county water and sewer department. The appointment of this commission has brought to the attention of the Chamber of Commerce, and recommendations have been made by James T. Taylor, second vice-president of the chapter and a consulting engineer of Honolulu, regarding the personnel of the commission and remuneration the members of it should receive. The president of the chapter is John H. Wilson, mayor of the city and county of Honolulu. The first vice-president is Lyman H. Bigelow, superintendent of public works and chairman of the Board of Harbor Commissioners of the Territory of Hawaii.

Additional appointments to the national committee on employment include A. A. Potter, dean of engineering in Purdue University; A. E. Harvey, chief engineer Kansas City Railways; H. W. McChesney, chief draftsman, C. M. & St. P. Ry, Chicago; C. W. Koiner, consulting engineer, Pasadena, California; Frederick Whitesell, mechanical engineer, Fairbanks-Morse Company, Chicago; John F. Johnson, service manager, Union Construction Company, Oakland, California; Wharton Clay, commissioner, Associated Metal Lath Manufacturer, Chicago. George C. D. Lonth, consulting engineer of Chicago Board of Local Improvements, is chairman of the committee.

Application of the Transportation Act of 1920 will be discussed by railroad members of the American Association of Engineers at meetings to be held at Parsons, Kansas, on September 1, Kansas City on September 2, Omaha on September 3 and Lincoln, Nebraska, on September 4. Assistant Secretary Brandt, who is in charge of the A. A. E. Railroad Department, will speak at each meeting. An effort will be made to determine methods of creating a better spirit of cooperation between the management and railroad sections, particularly in operating and economic problems. The association now has about sixty railroad sections.

The Illinois assembly of the American Association of Engineers has been organized with ten member chapters, and the Washington State assembly of A. A. E. will be permanetly organized at a state convention to be held at Everett, Washington, on August 24th.

The Nebraska Assembly of the American Association of Engineers, embracing the chapters of A. A. E. in Nebraska, announces the appointment of Ernest E. Trimble of Omaha as a full-time secretary, with headquarters in Omaha.

C. D. Lucas, resident engineer for the Cuyamol Fruit Company of Puerto Cortez of Honduras, is organizing a chapter of the association in Puerto Cortez.

The Washington assembly of the Amercian Association of Engineers was permanently organized on August

21 with G. M. Osgood, port engineer of the Port of Tacoma as president and Courtland Penny as secretary. The members of the executive board are Messrs. Sharp of Spokane, McMorris of Seattle, Tegitmeier of Everett. Presidents of all chapters in Washington are to be ex-officio members of the assembly executive board. A state license law was considered at the first meeting and decision made to have it introduced into the next legislature.

A feature of the 1920 membership campaign to be held by the American Association of Engineers from September 15 to October 30, is the agreement of the Chicago and New York Chapters to compete during the campaign for a silver cup. The Chicago Chapter, which now has about 1,500 members issued a challenge to the New York Chapter, which has about 1,000 members. The latter chapter has accepted the challenge and issued a statement declaring that it will not only obtain members to the association during the campaign, but will bring its membership to a total higher than that of the Chicago Chapter.

NATIONAL CONSTRUCTION CONGRESS

At a meeting held at Atlantic City, August 6-7, representatives of the Associated General Contractors ot America, the American Institute of Architects, Engineering Council, the National Building Trades Employers' Association, and the American Federation of Labor, decided that a building and construction congress should be permanently established, and appointed a committee to meet in Chicago, September 27, to plan for calling the congress.

PORTLAND CEMENT ENGINEERS

In Seattle, Aug. 16 and 18, a meeting was held of western district engineers belonging to the Portland Cement Association. The construction of concrete highways was especially discussed and a large amount of highway under construction was visited and aggregate plants were inspected.

AMERICAN CONCRETE INSTITUTE

At the sectional meeting held in New York, July 16, W. A. Slater of the U. S. Bureau of Standards, described investigations of shear strength of concrete that had been made by the Emergency Fleet Corporation.

MASTER BUILDERS ASSOCIATION OF WISCONSIN

A branch of this association to be known as the Marshfield Builders and Traders Exchange has just been formed at Marshfield, Wisc., with 25 charter members, R. L. Peterson, president, and Gus Krasin, secretary.

UNION OF CANADIAN MUNICIPALITIES

The 1920 convention of the union of Canadian municipalities was held at the Council Chambers, City Hall, Quebec, July 27. Among the principal papers presented were: Our Municipalities and Labor, by F. A. Acland. (Federal), Deputy Minister of Labor. Latest Ideas Respecting Public Health, by Hon. W. F. Roberts, M.D., Minster of Public Health, New Brunswick. The Municipalization of Public Utilities, by L. A. Herdt, Chairman of Montreal Tramways Commission. The Administration of the City of Quebec, by H. J. J. B. Chouinard, City Clerk of Quebec. Commission Government in Small Towns, by F. W. Gailbaith, Ex-Mayor of Red Deer, Alta. The Municipalization of Housing, by Rosaire Prieur, Mayor of Pointe-auz-Trembles, Secretary. Union of Quebec Municipalities. Recent Progress of Western Municipalities, by J. D. Saunders, City Clerk of Cambrose, Alta., Sec. Union of Alberta.

NATIONAL SAFETY COUNCIL

The 9th annual safety congress of the National Safety Council will be held at Milwaukee, Sept. 27-Oct. 1. Official representatives of all cities with a population of 25,000 or more have been invited, and the acceptances already received indicate an attendance representing more than 100 municipalities.

Exhibits showing every type of traffic signalling device on the market, automobile safety devices and other safety apparatus will be shown in machinery hall of the auditorium. Among the principal papers announced on the program are: "The Traffic Officer and His Relation to the Public," J W. Inches, M. D., Commissioner of Police, Detroit; "Law Enforcement and Its Application," Judge George E. Mix, Municipal Court, St. Louis.

Report of Committee on Traffic Hazards, Louis J. Smyth, director, Kansas City Division, National Safety Council, Kansas City, Mo.; Report of Committee on Public Utilities, R. E. McDougall, Rochester Railway Company, Rochester, N. Y.

"Hazards in Line Construction-Handling Poles, Erecting Poles, and Reconstruction of Old and Antiquated Lines," F. W. Fisher, Rochester Railway and Light Company, Rochester, N. Y.; "Accident Hazards in Laying Conduit Underground," H. W. Lueck, Commonwealth Edison Company, Chicago.; "Accident Hazards in Laying Gas Mains," R. S. Carter, Supt, Malden and Melrose Gas Light Company, Malden, Mass.; "Utility Accidents to the Public Prevented Through School Safety Education," Dr. E. Geo. Payne, Principal, Harris Teachers' College, St. Louis.; "Medical Service in Public Utilities," Dr. C. H. Lemon, Chief Surgeon, The Milwaukee Electric Railway and Light Company, Milwaukee, Wis.; "Hazards in Building Additions to Power Plants—Protecting Operators and Equipment," W. H. Mulligan, Hydro-Electro Power Commission of Ontario, Toronto, Ontario, Canada.

AMERICAN ASSOCIATION OF PORT AUTHORITIES

The annual convention of the American Association of port authorities, Chicago, October 4-6, will discuss ports and harbors of the Middle West, and navigation of the Great Lakes and St. Lawrence river. Papers are expected describing the new harbor work at Vancouver, Portland, Oregon, and Toronto.

PERSONALS

Borck, George, has been appointed road engineer of Ottawa Co., Mich.

Dietzer, H. C., has been appointed state highway engineer of Mississippi.

Earle, D. M., has been appointed city engineer of Worcester, Mass.

Russell, G. A., has been appointed engineer of Geary County, Kans.

Mooney, B. E., has been appointed city engineer of Whitefish, Mont.

Berg, John, has been appointed state engineer of South Dakota.

Keith, Clark, has been made assistant engineer of the Essex Border Utilities Commission, in charge of water supply and sewerage systems of municipalities near the Detroit River.

Chapman, H. D., has been appointed city engineer and superintendent of streets, Richmond, Calif.

Haase, H. J., has been appointed water commissioner, Elmira, N. Y.

Routh, J. W., has opened an office at Rochester, New York, as consulting engineer for municipal work.

Ridley, C. E., city engineer of Port Arthur, Texas, has been appointed to take a course in the New York School of Public Service and will specialize in public administration and city management.

Walton, Col. Edward, has been put in charge of the district office for the Eastern District of the U. S. Construction at Washington, D. C.

Meredith, J. W., has been appointed city engineer of Antioch, Cal.

Easler, R. P., has been appointed manager of the West Coast Dredging Co., with offices in Antioch, Calif.

Johnson, A. M., has been appointed dean of the Engineering School of the University of Maryland and director of engineering research, specializing in highway work in co-operation with the U. S. Bureau of Public Works and the Maryland State Highway Department.

Carson, Gen. J. M., has been made head of the Construction Service of Quartermaster Corps of the U. S. Army. General Carson has done a large amount of construction at West Point and in the Philippines, has been depot quartermaster at New York and in France served in the A. E. F. as deputy chief quartermaster. In 1919, he was made zone supply officer at New York and later depot quartermaster at New York.

Suter, Brig. Gen. Chas. Russel, for many years in charge of Mssissippi River Improvements, in charge of fortifications and harbor work near Boston, on the Board of Engineers reporting on New York Harbor lines, and on the California Debris Commission, died at Brookline, Mass., August 7, at the age of 78 years.

Wright. A. H., a bridge and railroad builder, 89 years old, died at Springfield. Mass., August 16.

Staats. R. P., a building contractor who had executed a large amount of pier and dock work in New York Harbor, died August 8 at Great Barrington, Mass.

Harwood, R. E., civil engineer and road contractor, died at Springfield, Ohio, August 4.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

TARVIA SPRAYING MACHINE

The plank floor of the Back River Bridge, Hingham, Mass., has been protected with a coating of Tarvia applied as shown in the illustration and covered with clean gravel. The method is apolicable to any plank bridge with a solid floor, the life of which is greatly prolonged by it. The hard gravel surface forms a durable coating that resists the wear that would otherwise rapidly abrade the wood. Besides this the Tarvia-A has a preservative effect that is a valuable preventive of decay.

The floor planking should be thoroughly fastened to avoid vibration or displacement, and after being well cleaned, should, for an old floor, be primed with a cold application of Tarvia-B at the rate of ¼ gallon per square yard. After this has been absorbed Tarvia-A at a temperature of from 200 degrees to 250 degrees should be evenly distributed over the surface in the proportion of ½ gallon per square yard, preferably applied in two coats with a spraying machine. Clean ½-inch stone chips, slag or gravel being placed over the first coat.

If no spraying machine is available, the Tarvia should be applied with pouring pots, smoothed out with fibre push brooms and covered with clean ¼ to ½ inch gravel or stone chips, at the rate of about 1 cubic yard to 100 square yards of surface. When used on new planks or on creosoted planks, the priming coat is not required. This, and other road surface treatments are described and illustrated in a bulletin on special uses for Tarvia, recently issued by the the Barrett Company.

QUINTET VOTING PLACES

A bulletin issued by the Blaw-Knox Company describes an all-steel portable building that has been put on the market by them and is especially recommended for polling places and for other purposes where efficient, light, durable and attractive small offices are required.

This building, which is carried in stock in 12x12-foot sizes 8 feet high and in other dimensions, is made with patent pressed galvanized steel wall and roof sheets braced with structural steel members, all of which are standard and interchangeable. They can be stored when not in service. They are wind-proof, rain-proof and fireproof and of very rigid construction with six windows, and paneled door. The complete building can be quickly and economically erected by two men and can be transported on a wagon or truck. When not in use for other purposes, the buildings are suitable for storing roadbuilding equipment, tools and various supplies or materials, or for office use, being easily shifted from job to job or from place to place on the same job, and quickly assembled and knocked down without injury.

CLAY PRODUCTS

The Clay Products Association has issued for gratuitous distribution to city engineers and other officials, a booklet on sanitation, suggesting ways of promoting sewerage in their own communities. It is designed to create a desire for proper city sewerage by describing bad living conditions in an unsewered town and good living conditions in a fully sewered town. It is proposed to follow it with another dealing specifically with the same subjects.

NEW PAVING ENGINEERING OFFICE

Dow & Smith, Chemical Engineers and Consulting Paving Engineers, announce that they have established a branch office at Columbia, S. C, which is in charge of T. Keith Legare, District Engineer. Mr. Legare was formerly conected with the engineering department of the city of Columbia for eleven years and has had extensive experience with various types of street paving. Service will be rendered in all matters pertaining to paving and road building, analysis of materials, inspection of work, specifications and general consultation.

SPRAYING "TARVIA-A" OVER PLANK FLOOR OF BACK RIVER BRIDGE, HINGHAM, MASS.

PUBLIC WORKS.
CITY 'COUNTY STATE
A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"
Vol. 49 FLORAL PARK, SEPTEMBER 11, 1920 No. 11

Flow of Water in Ditches

Experiments conducted by engineers of the Bureau of Roads to determine the proper values of the co-efficient in Kutter's formula for various conditions of channels in earth; the conditions being indicated by photograph, cross-section and description.

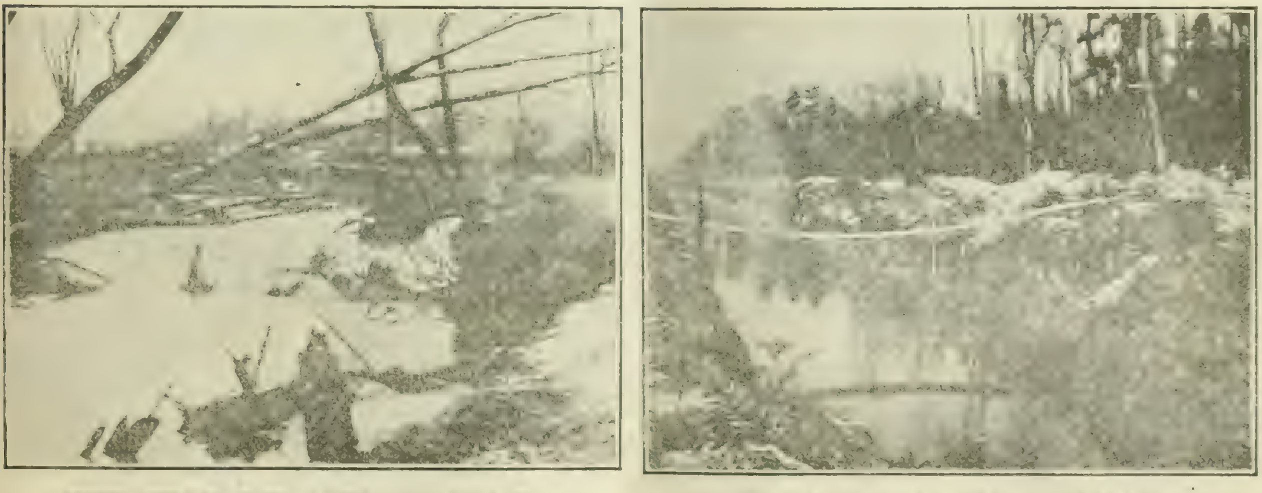
An extensive series of experiments to determine the coefficient of roughness in Kutter's formula has been carried on under the direction of C. E. Ramser, senior drainage engineer of the Bureau of Public Roads of the U. S. Department of Agriculture, and a description of the tests is given at length and the conclusions set forth in a professional paper published by the department under the date of June 7, 1920.

Mr. Ramser quotes the engineers of the Miami Conservancy District as holding the opinion that "Although the Kutter formula is not ideal, it is the best equation available at the present time." The reliability of the value of formula depends upon the selection of the coefficient of roughness *n*. The experiments which are described were made for the purpose of determining just what values of *n* properly apply to the various conditions of channel in the case of dredged drainage ditches.

Mr. Ramser calls attention to the fact that the value of *n* is affected not only by friction on the bed of the stream, but also by irregularities in the wetted perimeter, non-uniformity of cross section in size and shape, growth of vegetation in the channel, and presence of other obstructions to flow, such as rocks, drift, etc. An engineer who has not had wide personal experience in the selection of *n* for different conditions of channels must depend for a choice of value upon descriptions of channels as given by others. In this report photographs and careful descriptions of the channels for which the values of *n* were determined are presented as being the best method of making the results of the investigation practically applicable for use by other engineers.

Experiments were conducted in six different localities in Mississippi, Tennessee, Iowa, North Carolina, and Florida. Four sets were made by by Mr. Ramser, those in North Carolina by A. D. Morehouse and those in Florida by F. E. Staebner, all three drainage engineers of the Bureau of Public Roads. They were conducted under the direction of S. H. McCrory, chief of drainage investigations.

Because of the necessity just stated of selecting, for any given case, a value of *n* which has been found to apply to a channel as nearly as possible similar to the one in question, the special value of the report lies in the complete set of photographs and descriptions which accompany it. The photographs, sections and tables shown



SOUTH FORKED DEER RIVER (OLD CROOKED)
Channel Clogged with Stumps and Brush.

LITTLE JACOB SWAMP DREDGED CHANNEL
Shows Suspended Foot Bridge for Measuring Current Velocities.

COURSES OF RIVERS AT WHICH SLOPE OR FALL OF SURFACE WAS DETERMINED.

herewith give an illustration of the completeness with which the descriptions of the various ditches measured are given in the report. In addition to these data, the bulletin gives a few conclusions from a study of the results which were reached by the author, these being as follows:

CONCLUSIONS

"(1) That a deposit of slick, slimy silt on the sides and bottom of a channel greatly reduces frictional resistance to flow.

"(2) That the clearing of perennial growth from a channel will greatly increase its capacity.

"(3) That the growth of grass and weeds in a channel during the summer greatly decreases its capacity.

"(4) That the accumulation of drift, trees, logs and other obstructions in a channel greatly decreases its capacity.

"(5) That after a certain amount of erosion has taken place in a channel, further erosion does not necessarily increase the roughness of the perimeter.

"(6) That the roughness coefficient *n* is appreciably higher for a roughly dredged channel than for a smoothly dredged one.

"(7) That ordinarily a dredged channel quickly deteriorates in hydraulic efficiency unless systematically maintained.

"(8) That abrupt variations in cross section play an important part in reducing the hydraulic efficiency of a channel.

"(9) That generally, in designing a proposed dredged channel, a value of *n* of 0.030 should be used if the channel is to be smoothly dredged, and of 0.035 if roughly dredged. If the above values are used, the channels should be carefully maintained, and if not to be so maintained a value of *n* should be selected in accordance with the worst anticipated conditions for the channel. However, if it is known that such conditions will obtain as were found for some of the channels in western Iowa, a somewhat lower value of *n* may be used, depending upon the anticipated conditions of the channel.

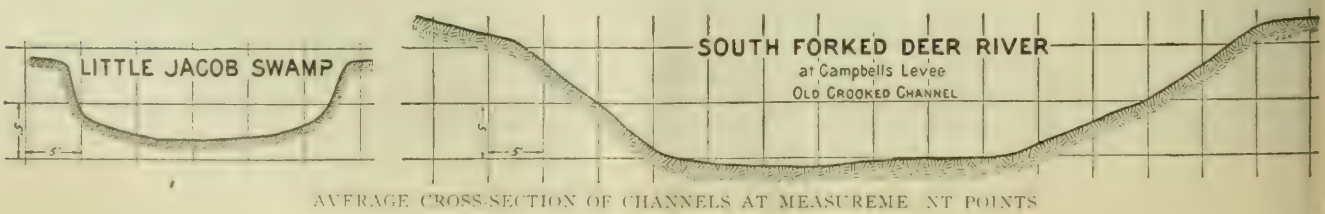
"(10) That in computing the capacity of an existing channel the value of *n* chosen should, whenever possible, be based upon a comparison of the conditions in the existing channel with the condition of channels for which values of *n* have been determined; such comparison being made, if not by actual inspection, at least with the aid of careful descriptions and views of the investigated channels."

In connection with the use of the report for determining the value to be employed for *n* in any particular case, the author gives the following suggestions:

"In order to determine the capacity of a proposed dredged channel, it is necessary to assume anticipated conditions of channel. As is readily seen from the results of these experiments, values of *n* for dredged channels vary greatly, depending principally upon irregularities of side slopes and cross section due to erosion, caving banks,

Date of observation.	Average maximum depth.	Average surface width.	Discharge.	Average cross section.	Mean velocity.	Mean hydraulic radius.	Slope of water surface.	Coefficient in formula $V = C\sqrt{RS}$	Coefficient of roughness *n*	Description of Channel.
Little Jacob Swamp Dredged Channel near Lumberton, N. C.										
DURING WINTER MONTHS										
Feb. 22, 1915	0.9	13.0	6.5	10.3	0.63	0.69	0.000448	35.8	0.0332	Course, straight; 500 feet long. Cross section, very little variation in shape; for variation in size, see fig. 10 D. Side slopes, fairly regular. Bottom quite even and regular. Soil, clay; sandy bottom due to silting. Condition, some moss along course; very little foreign material in channel. Constructed, July, 1913.
Jan. 13, 1915	1.0	13.6	13.7	12.4	1.10	.79	.000738	45.4	.0282	
Jan. 1[illegible], 1915	1.5	17.[illegible]	24.1	19.6	1.23	1.08	[illegible]	47.1	.0293	
Jan. 25, 1915	1.6	17.5	26.7	20.5	1.30	1.11	.000566	52.0	.0270	
......	[1] 7.0	....	....	....	....	....	....	....	.....	
DURING SUMMER MONTHS										
June 28, 1915	0.65	10.0	2.2	6.3	0.35	0.50	0.000308	28.2	0.0362	Course, same as next above. Condition, light growth of grass and weeds along edge of low water flow.
June 15, 1915	.7	10.5	2.8	6.8	.41	.53	.000314	31.7	.0335	
June 11, 1915	[illegible]	11.0	4.5	8.6	.52	.62	.000322	36.8	.0310	
May 19, 1915	.9	12.0	5.4	10.1	.53	.70	.000360	33.3	.0348	
May 15, 1915	1.4	17.0	15.4	17.4	.89	1.01	.000318	49.7	.0272	
May 13, 1915	2.2	20.0	29.5	32.9	.90	1.55	.000176	54.5	.0275	
....	[1] 7.0	....	....	....	....	....	....	....	.....	
Old Crooked River Channel										
Mar. 20, 1916	5.1	46.5	395.2	241.2	1.64	4.15	0.003773	13.1	0.1520	Course, very crooked, containing four distinct curves; 705 feet long at low water. Cross section, large variation in shape; for variation in size, see fig. 6 M. Side slopes, very irregular. Bottom, very irregular and full of holes. Soil, sandy clay loam. Condition, many roots, trees, and bushes on sides, and many logs, large trees, and other drift on bottom; trees are continually falling into channel, due to caving banks.
Feb. 25, 1916	6.5	50.0	545.9	311.5	1.75	4.99	.003812	12.7	.1620	
Mar. 29, 1916	7.6	54.0	735.7	366.0	2.01	5.56	.003450	14.6	.1500	
Mar. 4, 1916	7.8	55.0	715.1	376.7	1.90	5.68	.002709	15.3	.1460	
Feb. 3, 1916	11.1	64.5	1006.6	575.8	1.85	7.60	.001486	17.4	.1400	
....	[1] 13.0	....	....	....	....	....	....	....	.....	

[1] Average maximum depth at bankful stage.



AVERAGE CROSS-SECTION OF CHANNELS AT MEASUREMENT POINTS or faulty construction; upon obstructions and growth in the channel due to a lack of maintenance; and, under certain conditions, upon the effect of a lining of silt in the channel. In most cases where erosion takes place in a newly-constructed and well-finished dredged channel, the roughness coefficient increases but the capacity of the channel as a rule also increases, since the enlarged cross section more than offsets the effect of the increased roughness coefficient. In some instances practically no difference in capacity in a newly dredged channel may result due to erosion, after a certain amount of erosion has taken place, as was found to be the case for the experiments conducted at Trenton, Tenn."

For actually measuring the discharge, the gauging stations were with few exceptions located on single-span bridges so that there was no interference with the natural flow of the water. Where suitable bridges did not exist at desirable sections, temporary suspension foot bridges were constructed spanning the ditch. At one site a cable was used, from which the carriage carrying the observers was suspended.

The velocity measures were made with a small Price current meter. They were made at intervals of 2½ feet across the stream for the smallest channels, at 5-foot intervals for medium-sized channels, and at 10-foot intervals for the largest channels. At each measuring point the velocity was determined at the surface, mid-depth and the bottom of the stream. In a few instances the velocity was measured at 0.2 and 0.8 of the depth.

Carefully made soundings were obtained during low-water stages at the velocity-measuring points and also wherever a decided change in the perimeter of the channel took place. As a check on these measurements and to detect any changes due to silting or erosion, soundings were made also at the time of the velocity measurements.

Macadam is "Pavement" in Pennsylvania

In cases brought to trial in certain cities of New York state, if we remember correctly, it has been decided that macadam is not a "pavement" as that term is used in the laws which provide that property owners can be assessed for the cost of only one pavement, and that repairs and renewals must be paid by the city at large. The city of Pottsville, Pennsylvania, is now confronted with the necessity of repaying to Market street property owners the amount which they had paid to the city as an assessment of benefits in connection with paving that street with wood block.

It seems that, when the city endeavored to assess all property owners for their share of this pavement, some of them refused to pay the assessment, claiming that the macadam which they had already paid for constituted a pavement under the law and that, therefore, they could not be assessed for any further paving. This view was upheld by the Schuylkill county court and also by the Superior and Supreme courts, all deciding that the council had no power to levy an assessment for a pavement where the property owners had already paid for macadam in front of their properties.

The legal snarl is by no means settled, however, since it was found that council had no power to return money that had been paid into the treasury; some claiming that they cannot do so even if the legislature has passed an act enabling them to do so.

In spite of this experience of Pottsville, it is said that a number of cities in the state are assessing the cost of repaving streets under similar conditions.

Cause of Waves in Asphalt Pavements

In the July 24th issue of Public Works we published an article calling attention to the fact that English engineers have been showing an appreciation of American practice and paying considerable attention to the methods used in this country, recommending many of them for adoption. In the July 22nd issue of the London paper therein quoted from we find the following letter, in which the American type of asphalt roller is described as being superior to the English type.

(To the Editor of Municipal Engineering and The Sanitary Record.)

Sir.—The correspondence on this subject is highly interesting and most instructive. But I cannot agree with "Asphalt in your last issue, who appears to conclude that there is only one cause governing the corrugation or waviness of asphalt roads. There are, in my opinion, several, of which the following, as one who has supplied and laid a very considerable number of thousands of yards, are examples, viz.:—(1) Improper laying of the material with workmen of insufficient experience, for the material should be laid at a given temperature. If it is allowed to fall below a minimum temperature, the material will come out in a lumpy state from the vans delivering it on the road. (2) The iron rakes for levelling out the material are not made sufficiently hot to penetrate into the asphalt, the consequences being that the raking out of the lumps is not effected. They are scratched over only, and corrugations result. (3) Improper types of rollers used for oiling asphalt macadam are, in my opinion, another cause of corrugations. That this is so, I have proved when laying asphalt macadam into two adjacent roads with two different types of rollers, viz., one of the English type, where the engine is built above the level of the wheel axles; whilst the other was of the American type of roller, with the engine below the level of the axles, and so low indeed that it is only about 8in. clear of the ground. Much superior results were obtained with the latter roller, although the conditions as regards the composition and the heating of the material, etc., were similar. The presence of corrugations in the former and their absence in the latter were very perceptible. (4) Another cause of trouble arises from excessive thickness of the material, producing unequal compression. The standard thickness of 3½ in. in two-coat work should not be exceeded. (5) The improper bonding of the upper and lower coats is another cause leading to the formation of corrugations If the lower or under coat is of too coarse material, then the upper or carpet coat material is driven into it. The proper gauging of the materials of the two coats is most important, and especially, too, is the combination of the gauges of sands in the upper or carpet coat.

These are, in my experience, some of the causes which lead to the corrugations or waviness in asphalt macadam.

Yours faithfully,

July 17th, 1920. Road Builder.

Hydraulic Fill Construction of Huffman Dam

Deficiency of fine material for core supplied by excavating hillside with monitor and sluicing it to core pool at minimum cost.

The building of the Miami Conservancy works furnishes the most recent and important illustration of the construction of great earth dams by the hydraulic fill process that has been developed since its first use many years ago in placer mining.

The conduct of the Miami Convervancy work under the charge of an able board of designing, supervising and consulting engineers that have made thorough investigations, analyses, experiments and tests, has done much to advance the theory and practice of construction by this method and to govern them by rational considerations and practical operations. Careful studies have indicated the causes of failures of some previous hydraulic fill dams and have shown their remedies. Accurate observations and records of the progress of the work have also demonstrated the stability of the work in progress, and provided data from which the engineers have been able to modify the designs and operations so as to secure safe and economical results under varying conditions.

In the construction of the Huffman dam, difficulties that were anticipated before the work was commenced have been met and successfully surmounted by a method here described, which varied the character of the material used, improved and reduced the total cost. This was accomplished by supplementing the original supply of material by a second supply and by varying the details of the methods employed for handling it.

The five great conservancy dams in the Miami valley are all being built by the hydraulic fill method, as described at some length in the May 8 and 15 issues of Public Works. As there stated, there are three essential elements in each dam—the levees, beaches, and core. The correct proportioning of the core to the other elments of the dam is of vital importance because, if the core is too thin, it is likely to lack water-tightness, and if too thick, it may burst through the sides of the dam before the original semi-fluid consistency becomes hardened to its final character. In the conservancy dams, the thickness of the core at any point is made approximately equal to the distance from that point to the top of the dam, thus making the maximum thickness not more than one-fifth of the width of the dam base.

Great care was exercised in selecting the materials for the Miami dams, which were chosen in accordance with indications given by test borings sunk to explore the subterranean strata, and in accordance with the position of the material relative to the dam and the facility of excavating and transporting it.

In the case of the Huffman dam, the principal borrow pit was located in the bottom of the valley just above the dam site, where the graded material secured for the levees, the beaches and the core, was lacking in a sufficient proportion of fine material for the last named. As the dam progressed, the water delivered to the core pool, which was kept at normal height and width, deposited so little sediment that the silt thus supplied was insufficient to fill the interstices between the particles of sand and gravel in the retaining embankments and the latter were thus unable to keep themselves water-tight. Consequently the water leaked through the beaches and levees at the rate of about 6,000 gallons per minute, requiring the operation of a 15-inch dredge pump to maintain the required pool level, and caused a serious deficiency of the sedimentary deposit necessary to bring up the body of the core to its required position.

The obvious remedy for this difficulty was to provide a larger proportion of fine material in the gravel, earth, silt and sand that were discharged through the pump pipes into the core pool.

It would have been possible to accomplish this by limiting the depth of excavation in the borrow pit, but at a considerable increase of the cost of digging and transportation. Another method considered was by steam shovel excavation in a clay bed at another point and the transportation of this spoil to the hog-box, where it could be mixed with the material from the regular borrow pit, an operation which also involved considerable expense in the purchase of an additional plant. Both of these plans were abandoned in favor of the one indicated in the accompanying diagram, which was adopted and is giving excellent satisfaction.

An hydraulic monitor was installed on the hillside at a point about 200 feet from the north end of the dam and 25 feet above it, where the soil was composed of 2 to 8 feet of yellow clay with some sand and gravel and 4 to 12 feet of hard blue clay laminated in places with shale.

The monitor, working up the steep slope, excavated 6 feet or more of this surface material which was washed down to the bottom of the excavation and thence sluiced to the bottom of the hill The elevation of the borrow pit and the distance from the dam were such that a considerable portion of the material could be sluiced directly to the core pool. The remainder was sluiced to a sump and then pumped to the pool.

HYDRAULICKING.

The additional core material is excavated by a special hydraulic monitor designed with a very powerful jet, enabling it to cut through the refractory clay and shale strata and supply sufficient water to sluice the spoil without the additional low pressure stream generally supplied for this purpose.

The monitor is 15 feet long and, with a water supply of 3,800 gallons per second at 135 pounds pressure, throws a 5-inch jet with a muzzle velocity of 140 feet per second. It is operated by two 10-inch centrifugal pumps connected tandem with the outlet of one discharging into the suction of the other, and each operated by a 200 h. p. motor.

Water from the Mad river is supplied through a ditch M to a sump S, as shown in the plan and diagram. The pumps and motors located in the pump house D deliver through the high pressure pipe C to the monitor, which was first located at T and afterwards at U, successively excavating the slope up to the lines E, F, and G which is bounded its upper limits on May 1st, June 1st and July 1st, showing the relative progress of the work. The dotted line H indicates the possible limit of the borrow pit, which, being governed by the slope at which the excavated materials can be delivered by sluicing to the bottom of the pit at D, is determined by the height and horizontal distances, and provides for only a portion of the material required to complete the dam.

The minimum slope of the flume is governed by the maximum size of the stones carried through it, and in this case involved a grade of 3½ per cent for an open flume. As plenty of 15-inch steel dredge pipe was available, it was substituted for the ordinary open wooden box flume, reducing the frictional resistance to the water and permitting the development of pressure head in the lower part of the flume that enabled the outlet to be extended much farther than would have been the case with an open trough.

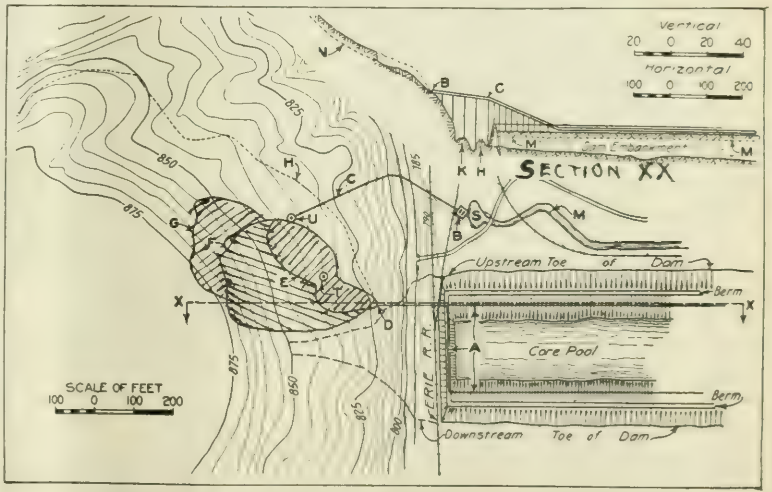
The flume commences at D at the bottom of the borrow pit and runs in a straight line over a low trestle to a convenient point on the dam, where it is connected with the U-shape distribution pipe that supplies both sides of the core pool. The minimum elevation of the upper end of the pipe was determined by the headway required above the Erie Railway H, and the highway K. This carried it well above the top of the adjacent cross dam protecting the railroad tracks, beyond which the slope is increased to 7 per cent, providing the required velocity and discharge through the horizontal distributing pipe.

This borrow pit contains a preponderance of fine material at one end and of coarse material at the other end. Where the material is about 80 per cent clay and the remainder sand and gravel, it can be transported through a flume with a grade of 1¾ per cent. In other places the proportion runs up to 25 per cent of clay and 75 per cent of sand and gravel up to 12-inches diameter and requires the 3½ per cent grade. All kinds of material are thus carried through the pipe, which is laid on the surface of the ground except where supported as shown on the trestle.

The excavation and transportation of material from the borrow pit requires the services of only five men—the pump man, the monitor man, a man at the flume inlet to keep it clear, and two men at the discharge end on the dam, except when additional help is required for a short time when it becomes necessary to move the monitor from one location to another.

The plant was put in operation about May 1st and has proved very efficient, requiring few shut-downs for repairs. The supply of fine material is satisfactory, as proved by the fact that a shut-down of 42 hours early in July only caused the pool level to be lowered about 2 inches while before the installation of the monitor and flume, a shut-down of only 13 hours lowered the pool 1.9 feet.

There has been no difficulty in maintaining the top of the core at its proper height relative to the sides of the dam since this apparatus was installed, and the material that it has handled has been put in position at about 48 per cent of the cost of placing material by the other method of excavating and pumping. Unfortunately there is not enough material available on the hillside to provide for the entire yardage necessary to complete the dam and it is therefore used only for the core construction, while the levees and beaches are built up with material provided by the original excavating and pumping plant.



LOCATION OF BORROW PIT, MONITOR AND PIPE FLUME FOR SLUICING FINE MATERIAL TO CORE POOL

This work is designed and supervised by the Miami Conservancy District, Arthur E Morgan, chief engineer, and Chas. H. Paul, assistant chief engineer. It is described in the Miami Conservancy Bulletin for August, from which our illustration is reproduced.

Improvement of Oswego's Water Supply

Report of expert engineers recommends modified lake intake, purification plant, extension of mains and other improvements.

The entire water works system and situation of Oswego, N. Y., have recently been studied by H. Malcolm Pirnie of the firm of Hazen, Whipple & Fuller of New York City, and a report with recommendations was submitted to the water department during the latter part of August on the basis of this. The water department has asked the common council to call a special taxpayers' election for the purpose of obtaining $90,358 for immediate necessary repairs to the water system.

The two most important changes needed in the plant are made necessary by damages to the intake, which extends for 8,700 feet into the lake to an intake crib in 76 feet of water; and by a river crossing, from leaks in which considerable water is escaping.

The intake pipe is reported to be broken off at a point 4,800 feet from shore where the water is only 37 feet deep, and where there is considerable danger and in fact certainty that sewage impurities from the river which flows into the lake will reach the intake and where also the water is warmer in summer than is desirable. Just how the intake came to be broken at this point is not definitely known, but the engineers believe it was caused by ice piling up at this point until it formed a solid mass to the bed of the lake and, moved by wind or current, carried the pipe with it, breaking it completely off at one point and opening up leaks at other points as well. It is found that the inshore 4,800 feet from the break to the pump well, is not tight and that 2 per cent of the supply enters through leaks in this distance. The temperature of the water occasionally rises to 70 degrees fahrenheit and the pollution is intermittently serious.

If all of the water could be drawn from the intake crib through a tight intake pipe, the physical properties would in general be excellent. Even then, however, there would be more or less danger of pollution from passing boats and other sources of pollution.

Chlorine is being applied to the water now, but the engineers recommend that an additional machine be provided at a cost of $1,000, that $1,200 be appropriated for a testing laboratory in order that the condition of the water may be kept track of continuously, and that $15,000 be spent in a rock fill for protecting the 4,800 feet of intake pipe from further damage. This is recommended only as a temporary remedy, and the city is urged to install a filtration plant as soon as it finds this practicable. Later, if it is thought worth while in order to obtain cooler water in summer, the outer section of the intake could be connected with the inner section, although such a repair made in deep water would be difficult and its permanency problematical. The cost of repairing the intake pipe would be about one-half the cost of filtration, providing that it was attempted to make the line only 90 per cent absolutely tight.

The consumption is considered to be excessive, being over 200 gallons per capita per day, due chiefly to leaking fixtures. It is recommended that all services be metered, including private fire lines. The engineers estimate that metering at a cost of $85,000 should be completed at once, but the department confines its request to $15,000 for fire line meters only.

A 20 inch river crossing is known to be leaking quite badly some 60 feet from the shore of the river, as indicated by an air test, but without dredging it was impossible to determine definitely the condition of the pipe at this point. The water department includes in its plan for immediate work a substitute bridge main with frost proofing and boxing at an estimated cost of $17,049.

In addition, it is proposed to reinforce the system of mains, especially by substituting larger mains for those which are 4 inches or less in diameter, at an estimated cost of $21,072; making improvements at the pumping plant at a cost of $4,500; reservoir fences costing $3,500, and contingencies estimated at $9,829.

The engineers estimate that a filtration plant would cost $327,000, exclusive of land, and that the estimated cost of all of the improvements recomended by them would be about $500,000.

Algae in Sacramento River

Citizens of Sacramento, Calif., have recently been noticing and objecting to a taste and odor in the water supply, which is obtained from the Sacramento river. C. G. Gillespie, of the filtration division of the city engineering department, has reported that the taste and odor are due to algae. It is a more or less common experience for various cities to be troubled with similar tastes and odors from algae growing in uncovered reservoirs, but it is not so common to have this trouble originate in rivers. Both Anabena and Diatoms have been found growing throughout almost the entire length of the Sacramento river, this being attributed to the long season of clear water which the river has experienced, combined with a seeding of the river by some returned drainage from rice lands and irrigated areas.

The department proposes filtration and aeration for removing the odors and tastes as well as for purifying the water, it being suggested that incidentally the aeration by spraying will have a decided cooling effect on the water.

Designing Aqueduct of Winnipeg Water Works

By James H. Fuertes

Studies of soil conditions and of special designs of inverts to meet the various conditions; the formation and repairing of settlement cracks, and the water-tightness and cost of repaired work.

DESIGNS OF INVERTS: FOUNDATION CONDITIONS

In the design of the inverts for the different sections of the aqueduct it was, of course, recognized that the soil to be expected in the trench bottoms would vary from a semi-fluid mud to solid rock. A large percentage of the total was of boulder-clay, hardpan, gravel, and rock, or of soft soil on top of solid materials above described. The first twenty miles, however, was through a prairie country, the soil of which was clay deposited from sea water ages ago and practically devoid of silt or ganular materials. This clay, however, is underlaid with a layer of gravel and boulders resting on the limestone rock some 40 feet or more below the surface.

This soil is very peculiar and uncertain in its action under loads, and many serious structural accidents have occurred in Winnipeg and vicinity as a result. Its compressibility is variable, depending on its depth below the surface and on its water contents. It appears that this variability is due, in part, to the action of frost when leaving the ground, and to drainage and evaporation of its water content during the dry summer weather. Frost appears to pulverize and loosen up the soil for a certain variable depth; drying cracks it open, sometimes to a depth of a few inches, in little blocks, hard in themselves, but resting on a softer base. Further drying, particularly if covered with humus or soil, sometimes opens up long continuous cracks often up to three inches in width at the surface, and extending down several feet. When in this condition, a rain will fill these cracks, cause the ground to swell, imprison the water in its mass and force it into the lower strata, maintaining these, more or less continuously, in a condition of semi-fluidity. Often there may be a mat, or raft, of dry soil on the surface, many feet in thickness, resting on lower strata in a state of saturation.

Soil tests taken from a dressed surface, which has had a day or two to dry, may sometimes give bearing values high enough to satisfy any reasonable foundation requirement. The same soil, under other conditions as to moisture, will flow under pressure like putty. But its worst feature is the condition of continuous, progressive settlement under a constant load, and greater relative settlements in smaller than in greater depths below the natural surface, under the same load.

COMPRESSIBILITY OF CLAY SOIL AT MILE 13

This is shown in tests made at Mile 13 (Deacon) in April 1916, and abstracted in the following table:

Depth of test area below natural surface	LOAD PER SQ. FOOT, 3,000 POUNDS Total Settlement in Feet at End of Day No.												
	1	2	3	4	5	6	7	8	9	10	11	12	13
4 feet	.023	.024	.025	.028	.028	.028	.031	.032	.032	.032	.032	.032	.032
5 reet	.027	.021	.029	.029	.030	.030	.032	.024	.035	.035	.035	.035	.035
7 feet	.017	.018	.018	.019	.020	.020	.020	.021	.021	.021	.021	.021	.021

Depth of test area below natural surface	LOAD PER SQ. FOOT, 6,000 POUNDS Total Settlement in Feet at End of Day No.												
	1	2	3	4	5	6	7	8	9	10	11	12	13.
4 feet	.077	.090	.098	.101	.103	.103	.103	.103	.103	.103	.103	.103	.103
5 feet	.076	.079	.081	.081	.082	.083	.084	.086	.086	.086	.086	.086	.086
7 feet	.030	.031	.032	.033	.034	.035	.035	.035	.036	.037	.037	.037	.037

From the above it is seen that doubling the load per square foot at a depth of 4 feet caused 3¼ times the settlement; doubling the load at 5 feet 2¾ times the settlement; and doubling it at 7 feet depth caused a settlement of 1¾ times that under the original load; also, that in all the holes and at all loads the settlement at the end of two weeks was about 1¼ times the amount at the end of the first day.

Repetitions of tests at other times showed this same general condition but never just the same total amounts. In all the above tests the ground was free from frost at the depths tested, but was moist, and in its natural condition for that season of the year. On the surface, when dry, this soil would be as hard as a good road surface, and could be marked with the heel only with difficulty.

VARIABILITY IN BEARING POWER

This variability in compressibility introduced conditions making it impossible to build on it any continuous structure that would be free from cracks when finished. The variable depth of excavation alone would produce this, as, the weight of the structure being the same, the varying compressibility of the soil at the different depths disclosed in building an aqueduct on a uniform grade would alone cause a wave to travel lengthwise of the aqueduct, as the backfilling progressed, resulting in transverse cracks and being a factor in the production of the longitudinal cracks. No cracks appeared in the aqueduct, either invert or arch, except under the weight of the backfill or the action of frost on unprotected work. Generally none showed with backfills of two feet or less.

These conditions were foreseen and fully weighed before proceeding with the design and

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*Continued from page 222.

construction of the inverts. Cracks were expected in this part of the work.

Further east, soft bottom was known to exist also in a number of locations of short lengths. These were, during construction of the work, either entirely dug out and refilled with water-settled sand and gravel fills, or else rolled embankments or pile foundations were used. A very few unimportant cracks occurred in the inverts in a few localities so treated.

SPECIAL INVERTS FOR VARYING CONDITIONS

In some places, particularly where roads and railroads crossed the aqueduct, the section was thickened and reinforced with steel bars to distribute the weight more uniformly over the entire width of the base, to prevent excessive local settlement.

Also, where ground water levels were so high as to tend to float the aqueduct, when empty, and where the backfilling materials were very light in weight, the aqueduct bottom was thickened sufficiently to add weight enough to resist flotation of the tube, and the bottom and arch reinforced, as required, against water pressure from without and within, as well as for backfill loads.

All these contingencies were foreseen and provided for in the preliminary estimates of cost. No special allowance, however, was made in these estimates for pile foundations, or other means to secure a rigid foundation for the work, through the prairie section above referred to, as it was the judgment of the engineers making the original report that this would not be necessary.

SETTLEMENT CRACKS

As a matter of fact, troubles from settlement had occurred only in about 1.6 of the 20 miles of contract 30 of this treacherous country; 0.45 miles of the 17¾ miles of contract 31, 0.2 of a mile of the 18.2 of contract 32; about 0.2 of the 16.1 of contract 33, and about 0.02 of a mile of the 13 miles of contract 34, by September, 1916, practically all the cracks having been in the 1915 works.

This date is given because subsequently a much more expensive form of construction was adopted to prevent such cracks, the changes consisting of using 8-inch extensions, or footings, on the edges of the invert, to reduce the maximum pressures to lower amounts on poor foundations, and using a heavy thicker invert, reinforced with steel, where the ground was less hard than the best.

REPAIRING CRACKS

None of the work above referred to as creacked was taken out or replaced. Most of it was repaired by cutting out the cracks to a width of about half an inch for a depth of 2 inches and packing the cracks with hammer-caulked neat portland cement, put in very dry and tamped very solidly, first washing all loose chips, sand and dust out of the prepared cracks with water under pressure.

This method of repair made a very strong tight joint; in fact the edges of the crack were knit together as strongly as though they had never been broken. Several sections of invert, including portions of these joints, have been cut out and tested. The cement filling, even after having been in place only two or three days, adheres so strongly to the concrete that when broken the break was generally in the old concrete, sometimes in the filling, but never at the junction of the two.

WATER TIGHTNESS OF REPAIRED WORK

Also, to test the tightness of the aquduct after repair, a number of sections were selected and tested; one of these, 270 feet long, was purposely picked out to include the most seriously damaged portion. In this section the invert had several longitudinal cracks, some open ½ inch at the surface, others of smaller widths, and the arch was cracked along the haunch on one side as well as along the top.

Bulkheads were built at each end of their section, which was then filled with water to the level corresponding to a rate of discharge of 85 million gallons per day. Daily records were kept of the drop in water level for some months and the rate of leakage was found to be less than 5,000 gallons per mile of aqueduct per day, which for this size of aquqeduct, equivalent to a circle 8.1 feet diameter, would hardly be called excessive for a cast iron pipe line with caulked joints. The average of the other tests gave a leakage of about one-third that amount.

COST OF REPAIRS

The actual cost of repairs of the 5,300 feet repaired, including labor, materials and incidentals, was less than half a dollar per foot of aqueduct repaired; in fact, about $2,500 in all.

With the greater experience gained both by the engineers and inspectors and by the contractors' men in securing more thoroughly compacted foundations, particularly along the sides of the inverts, practically all invert cracks could have been eliminated in future work without the use of heavy reinforced inverts.

(*To Be Continued*)

Automobile Revenue for Highway

That motor vehicles pay handsomely towards the construction and maintenance of highways is the opinion of R. E. Fulton president of the International Motor Company, manufacturers of Mack trucks. He estimates that in 1918, motor vehicles and their manufacturers paid respectively $150,000,000 and $33,000,000 in taxes, for licenses and for other government and municipal charges, which amounts to a total of about $25 for every car built.

Out of 2,500,000 miles of highway in the United States, only 6,250 miles are said to be satisfactory for heavy-duty traffic, and for this amount of improved roadway, the motor vehicles pay at the rate, if all their revenue was concentrated on it, of $24,000 per mile per year, while their actual payments amount to $75 per mile for every mile of highway, good and bad, in the country.

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Quicksand Methods

Much of the distrust that is often felt for construction work below ground level is due to the general fear of quicksand in making and maintaining excavations. Although it may be, and frequently is, a serious menace, it is often not so bad as feared, and under most conditions may be controlled and the work safely executed although perhaps at an increased expenditure of time and labor.

Quicksand is at its worse when encountered in large quantities in an excavation below, and especially immediately adjacent to, the foundations of existing important structures. Given proper experience and equipment, even this condition may be successfully handled, as has been demonstrated abundantly by foundation work in New York City where excavations have safely been made 100 feet below the surface in quicksand beds underlying the foundations of adjacent lofty buildings. In these cases, where depth and dimensions were extreme, pneumatic caissons have generally been found necessary and satisfactory often less elaborate and expensive methods serve even for large work and great depth, and since quicksand affords a satisfactory foundation when permanently and reliably confined, it sometimes suffices merely to carry the excavation below the probability of future adjacent excavations.

For isolated work where plenty of time and abundant equipment is available, the construction can usually be carried out by one or another of various methods, provided sufficient care, patience, and good judgment are exercised. Of course, with important work or where the difficulties are unusually great, expert engineers and contractors, experienced in such construction, should be employed or consulted.

For many kinds of work in which quicksand is incidentially encountered and no great depth or mass is involved, the difficulties can generally be overcome by simple methods selected or modified with good judgment and ingenuity, and the resolute, resourceful contractor need not have much fear or sustain very much loss.

In such cases the quicksand can generally be dealt with by confining it, draining it, maintaining equilibrium of pressure, or by executing the work in small units and with great rapidity. Practical operations for an assumed case of this sort are suggested on page 239.

When quicksand can be thoroughly drained, it ceases to be quicksand, and becomes one of the easiest instead of one of the most difficult substances to handle. If it cannot be successfully drained, it may be counter-balanced or handled in very small quantities and increased rapidity that permits it to be removed and permanently confined by successive small increments. Numberless variations of the details by which the work may be executed have been developed and can be still farther multiplied, always affording a fertile field for ingenuity, good judgment and economy.

The Cost of High Wages

An accurate measure of the cost of increased wages is afforded by the statement in the August Mid-Month Review of Business issued by the Irving National Bank of New York to the effect that the wage increases just granted to railroad employes by the Railroad Labor Board, will aggregate $626,000,000 a year, and, coming on top of many previous increases, makes the total annual railroad payroll $3,600,000,000, an amount more than twice as great as was required for the same purpose in 1916 when the railroad service was much better.

This is entirely consistent with the well known principle that increasing labor wages to an unusual amount or to a degree enabling the laborers to remain idle part of the time, greatly decreases their efficiency. Nearly or quite all of the large employers recently questioned in this matter agree that the cost of executing given units of some kinds of construction work is now four times or more as great as it was six years ago, the inevitable result of increasing wages 100 per cent or more, usually more, accompanied by the almost universal decrease of efficiency by 50 per cent or more. This does not take in consideration the much larger amount of time lost, nor the dissatisfaction, unreliability, and greatly increased turn-over of labor.

Good Roads Expenditures in 1919

According to a report by the Bureau of Census entitled "Financial Statistics of States—1919" soon to be issued, of the $71,320,765 representing outlays for all permanent improvements by the forty-eight states, a little more than one-third, or $23,845,093, was expended for the construction of new roads and the permanent improvement of existing ones. In addition, $24,180,975 was apportioned by the states to their counties, municipalities, and other minor civil divisions for use in the construction, improvement and maintenance of roads, and a considerable portion of this sum was employed in construction and permanent improvement.

The greatest outlays for roads by individual states were reported as follows: California, $4,891,094; Ohio, $2,721,708; New York, $2,411,690; Oregon, $2,163,479; Pennsylvania, $2,126,442; Michigan, $1,753,883; Utah, $1,262,282; Maryland, $1,101,556.

Only twenty-eight states expended money directly on the construction and improvement of roads during the fiscal year, but a number of others apportioned sums to counties, municipalities, etc., which was spent in the construction and improvement of roads. Seven states, however, reported neither outlays nor apportionments for these purposes.

During the year the net indebtedness increased 3.5 per cent and the per capita net indebtedness increased 1.9 per cent, averaging all of the states. During the same year the total value of public properties increased by 3.3 per cent and the per capita value by 1.6 per cent.

Dock and Warehouse for San Francisco

San Francisco is planning a system of ship, rail and warehouse facilities on the water front estimated to cost $2,300,000, the plans having been adopted by the State Board of Harbor Commissioners in the latter part of August. The president of the board, John H. McCallum, says that the project is superior to anything existing in the United States and that it will provide facilities for handling all cargoes of grain, cotton, seasonal fruit and tropical products at a minimum cost. Dockage will be provided for the largest ships. The warehouse will be the first multiple-story dock warehouse on the Pacific coast. It will be six stories high, 816 feet long and will provide storage capacity for 40,000 tons of freight.

Riverside Flooded by Rains

Riverside, N. J., has found its business center flooded several times recently owing to the unusually heavy and frequent rainfalls during the first three weeks of August. Shoppers and theatre patrons have found themselves marooned in stores and theatres after several downpours, with no method of escape except by wading through a considerable depth of water or the use of taxicabs. During one storm, water rose a foot above the floor of a restaurant, to the great discomfort of the patrons.

The trouble is said to be caused by the fact that the storm sewer draining the central part of the town is entirely too small and the township authorities have instructed engineers to have work begun on a new sewer at the earliest possible date.

For a Boston-Fall River Canal

Some years ago it was proposed to build a canal from Fall River to Boston, utilizing the Taunton river as a part of the route. The Taunton delegates to the October meeting of the Atlantic Waterways Association will urge this project, or at least a widening and deepening of the channel of the Taunton river, giving 100 foot width and 12 feet depth at low water.

This improving of the Taunton river was estimater to cost $534,000 when approved some years ago by the War Department, but would probably cost more now. The cost of the entire project from Fall river to Boston would run up into the millions but it was cleaimed that it would be of great benefit to the eastern part of New England. If the Taunton river part of the project is put through, it is proposed to transport goods from Taunton to the Great Lakes by water, using the Taunton river, Narragansett Bay, Long Island Sound, the Hudson river and the Erie Canal. Although the route is longer than by rail, it is cleaimed that the rates of freight transportation would be considerably lower and the time not much greater than rail transportation has required during the past few years.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

Excavating Foundation Pit in Quicksand

Methods frequently successful with limited deposits of quicksand or for pits of moderate dimensions.

In making excavations for foundations such as bridge piers, retaining walls, power stations, water works and sewer plants, or trenches for sewer, gas and watermains, deposits of quicksand are sometimes encountered that, unless properly handled, are likely to cause serious trouble to the contractor.

If the excavation is very deep, if there is a large mass of quicksand, if the work is otherwise delicate or of great importance, or if adjacent structures are likely to be endangered, thorough preliminary investigation should be made and the work should be planned and executed under the direction of an engineer experienced in similar work.

When the excavation is independent of existing structures and is of moderate dimensions, as for example, for land piers and abutments of small highway bridges, foundation piers, in wells, shafts, or for short sections of trenches, it may often be successfully performed with simple equipment and ordinary methods provided in advance or selected as required by the development of the work, if the latter is carefully and conservatively handled by an experienced ingenious man even though he has not previous familiarity with quicksand.

TYPICAL CASE

What is a safe and economical way to complete, in quicksand, the excavation of a pit 12 feet deep for a bridge pier with an 8x26-foot footing? The pier is assumed to be for the approach span of a light steel truss highway bridge and is located on level ground, about 2 feet above water level and 50 feet from the shore line of a small river not likely to flood during the progress of the work.

Consider that about 2 feet of fine black loam was excavated with scrapers down to a bed of sand with some clay and gravel that extends to a depth of 6 feet below the surface; that the sand is hard and solid and stands up with a vertical face in the upper part, but below the groundwater line, about 3 feet below the surface, it is very wet and caves in with the flow of water; that this sand was excavated by hand without great difficulty to a depth of about 2 feet; that the trouble from the water became worse requiring two hand pumps and later a 3-inch gasoline pump that managed to keep the water down; and that the sides were faced with braced sheeting boards.

Assume also that at the depth of 6 feet below the surface, the sand is very fine, wet and of a greasy feeling, and flows into the excavation as fast as it can be dug out. If a small hole is excavated a foot or two below the surface of the sand, it will immediately fill with water and the sand will boil up in the bottom, soon rising to the original surface. The top of the sand is so soft that the men sink into it as in mud, and excavation has been suspended.

This quicksand may perhaps be part of the former bed of the river, and can probably be excavated without serious difficulty or great expense. Possibly the stratum may be only 2 or 3 feet deep, in which case it can be easily handled. If it is much deeper it will take more time and trouble, and if it is very deep it will require slow and careful work that, however, should be managed without very great difficulty for the maximum depth of 6 feet here required.

EXPLORATION

The first thing to do is to determine, if possible, the depth of the quicksand, which may or may not be easily accomplished. If it is shallow and underlaid by a stratum of gravel, hard sand, clay or other hard material, indications will be secured by soundings with a ¾-inch steel rod or its equivalent, driven down a few feet which will show clearly when it reaches hard bottom. If this is found to be at about the same elevation all over the excavation, it will show the limit of the quicksand well enough, but if it does not encounter resistance or obstruction, the quicksand may extend to a still greater depth or it may, without being apparent, change at any point to sand that is not quicksand.

If this is uncertain, better indications may be obtained by driving down a good-size steel pipe, say 4 inches in diameter, and excavating the interior with a spoon, small scoop, or bag on the end of a pole, thus bringing up samples that will show the character of the soil to as great a depth as the pipe can be driven and excavated. Driving this pipe or even a larger one will also be useful in providing a sump through which to pump down the ground water.

SHEETING AND DRAINING

If hard bottom is found within 10 or 15 feet of the top of the quicksand, the pit should be protected by a continuous wall of sheet piles driven completely around it and reaching down to penetrate the hard stratum if possible. This sheeting must be as nearly water-tight as possible, and may be temporary or permanent and of wood or steel according to the contractor's facilities and the estimated final cost and salvage. Light steel piles will drive easier, make a tighter wall, and have greater salvage than wood. They can be driven with a light air hammer or a drop hammer. Wooden sheeting probably cannot be driven with as light a hammer as will suffice for the steel and probably cannot be pulled and redriven or salvaged to as good advantage, if at all.

If the piles are carefully driven and penetrate to hard bottom, it will probably be possible to lower the ground-water level by pumping from one or more sumps so that the quicksand can be excavated to subgrade without great difficulty. In some instances this may even be acomplished without sheeting but is likely to be very slow and expensive. If the leakage through the sheeting is great, it will be better to make the excavation in several transverse sections, each carried down to the required depth before the next is commenced; and in each, stop the leaks by patching, plugging, puddling, etc., as they are exposed.

SECTIONAL EXCAVATION AND CONCRETING

If the sheeting is not driven to hard stratum, or if the pumping does not dry out the quicksand and the bottom boils up badly, it will probably be best to make the excavation in very small successive sections, completing each and sealing the bottom with concrete before commencing the adjacent one.

This substantially amounts to sinking a number of separate pits, from 3 to 6 feet wide according to conditions and the convenience of the men. Each pit should be enclosed temporarily with sheeting driven down by hand if more convenient, and kept a little below the bottom of the excavation as the work progresses, and should be drained by pumping through a sump or a well point driven in one corner.

By rapid, continuous work of two or three men over a small area thus protected, the small pit can be carried down 6 feet and must immediately be sealed by covering the bottom with concrete thick enough to have sufficient weight to overcome the upward pressure and hold the quicksand down. If this is not practicable, the concrete should be at least 12 or 18 inches in thickness and may have inserted a short length of old pipe reaching through the quicksand and projecting vertically above ground water level to relieve the pressure. After the concrete has been deposited, the water should not be pumped out of the pit until the entire excavation has been completed. After the completion of one pit, another may be excavated and concreted in the same way, and so on, until the entire excavation is finished, two or more gangs working simultaneously on different pits if necessary. After the excavation has been finished it should be pumped out, and the vent pipes, if any, cut off and securely plugged. The remainder of the footing may then be concreted in the dry, and the sheet piles salvaged or left permanently in position.

New York Buys Motor Trucks by the Hundred

Two hundred and twelve motor trucks and seventy-five motor flushing machines for the Department of Street Cleaning.

New York City on August 20 received bids for 212 gasoline trucks and 75 motor-driven street flushers, and awarded the contract a few days later to The White Company. The contract price for the trucks without flushing equipment was $1,215,790.55.

The specifications call for gasoline motor-driven trucks with four wheels, rear wheel drive, front wheel stear, engine under hood, to be used by the Department of Street Cleaning. The body to be a back dumper of steel construction with a capacity of 162 cubic feet (water level measurement), operated by power hoist. The truck to be nominally of 5 tons capacity. No manufacturers were allowed to bid who had not been engaged in the manufacture of motor trucks and motors for trucks for at least eight years or which did not have at least 100 of its make of chassis of 5 tons or greater capacity in operation in the United States, each of which had given at least 75,000 miles of service. Moreover, the company must have had in operation for at least six months prior to the time of bidding and still have a service station within 15 miles of the Manhattan Municipal building equipped with spare parts for 5-ton trucks, at which stations are inspectors for the purpose of inspecting, at regular periods, chassis which are in operation in this vicinity.

The engine was required to be a 4-cylinder, 4-cycle engine which will develop not less than 35 brake h.p. at governed speed, suspended at three points. The specifications described in detail the requirements of all features of the engine and chassis. As an illustration: "Front axles and rear axles shall be of carbon or alloy steel, suitably heat treated, and shall have minimum physical characteristics as follows: elastic limit 60,000 pounds per square inch; ultimate strength, 80,000 pounds per square inch; elongation, 16 per cent; reduction of area, 45 per cent; Brinell hardness, 200."

The wheels were required to be of steel disc type or steel spoke type; the tires single 36x6 front and not less than dual 36x6 rear, to be of high profile, solid base, pressed-on type.

The dumping body is to be built throughout of steel not less than 3-16 inch thick, so designed that it and the hoist may be easily dismounted so that the chassis may be used for carrying a flushing equipment. The body is to be designed for side loading with ash cans and provided with 6-inch hinged sides, the hinges being so placed that when the sides are down they will not interfere with the rolling of ash cans. When the hinged sides are up, the loading height over the rear wheels must not exceed 63 inches when the truck is loaded with 10,000 pounds. The body is not to exceed 86 inches in side measurement. The body is to be so constructed that it will carry 10 cubic feet of water without reaching the bottom edge of the tail gate. The tail gate shall be tight closing and operated from the driver's cab. The body must dump to an angle of not less than 45 degrees from the horizontal. There will be suitable metal rings or eyelets along the sides and ends of the body by which to fasten on a canvas cover.

Each truck has a dash bracket for attaching a standard push snow plow. The truck is fitted with four shovel racks or hooks.

The completed truck will be required to show its ability to travel with a load of 10,500 pounds and with the additional weight of a driver and one other man, over a specified route which is approximately 14 miles long and includes several severe grades, the steepest of which averages 9.8 per cent for 2,000 feet, making the run in 90 minutes without excessive heating in any part and without showing evidence of weakness. In addition, each chassis and dumping body and equipment will be tested on house-to-house collection for a period of not more than 6 days, including the carrying and dumping of 7 tons of sand without showing evidence of weakness. The manufacturer must guarantee that, for a period of one year, he will replace all broken parts and make all repairs that may be required or made necessary by reason of defective design, materials or workmanship, without any cost to the city.

In addition to the truck, 75 flushing equipments were called for, there being two alternate bids, one for "flushing equipments complete, based upon driving the pump with power taken from the truck engine, or, by means of a separate motor. Any bids made under this alternate must be based upon furnishing the latest and most improved type of engine, pump and equipment complete used by the manufacturer of the flushing equipments." In either case, the flushing equipments must be so designed that they can be removed and replaced by the dumping body, or vice versa. The former of these alternatives was the one contracted for.

The water tank is to be an oval tank with a capacity of not less than 1,200 gallons, with at least two baffle plates, suitably supported on cradles attached to the frame of the chassis. It shall be of not less than No. 7 U. S. Standard gauge and withstand a static pressure test of 45 pounds. The pumps must be capable of delivering 350 gallons per minute with 35 pounds pressure at the flushing nozzle when the motor is running at its governed speed. Four power flushing nozzles and 2 sprinkler heads will be furnished in suitable locations, the flushing nozzles being "so arranged as to discharge water on the street at an angle which will effectively clean all classes of street pavements now in use in the city of New York and the stream shall be effective for a distance of 6 feet with two nozzles operating in the same direction." All levers for control of nozzles and sprinkling heads will be located convenient to the driver of the truck so that one man may both drive and operate the machine. Each nozzle and sprinkling head will be provided with a separate control.

Immigration Notes

International Labor Office

Under the terms of the treaty of Versailles, the International Labor Office is under the control of a governing body of twelve members representing Belgium, Germany, Switzerland, Spain, Argentina, Canada and Denmark, six members elected by delegates to the International Labor Conference held in Washington, November, 1919, and six delegates representing employers.

At present the International Labor Office is divided into two principal divisions, diplomatic and scientific. The diplomatic division will negotiate with the different governments, employers' organizations and trade unions for the ratification of the conventions adopted by the International Labor Conference, the most important of which are the six that were adopted at Washington and which limit the hours of work in industrial undertakings to 8 in the day and 48 in the week. The scientific division will collect information on the social and economic problems of the world and publish it.

There are also six technical sections, employment, seamen, agriculture, Russian inquiry, social insurance co-operation, and emigration. The emigration and employment sections are co-operating with the International Immigration Committee on the problem of reciprocity of treatment of worker immigrants. A commission has been appointed to report measures adapted to regulate the migration of workers out of their own states and to protect the interest of wage earners residing in states other than their own.

It is reported that on account of strikes in the mining districts of Salamanca, Spain, large parties of workmen have decided to leave the country and that many of them will come to the United States. In a village in the province of Guadalajara, every male adult, except the mayor who is aged, has decided to emigrate to the United States, and will soon be followed by their families.

Dispatches from Danzig state that there are now in that city at least 50,000 Jews ready and waiting to immigrate to the United States.

During the week ending August 28th, 80,690 aliens arrived at the port of New York and on August 28th, all records were broken by the inspection of 15,438 immigrants at Ellis Island while 3,253 were still awaiting inspection. Commissioner of Immigration Wallace, who has often been quoted as expressing his opinion to the effect that great numbers of immigrants are waiting to come from Europe and that it is only a question of enough ships to bring them here, added to it, that from information received from many ship's agents, he believed that a still greater number of immigrants would arrive on the week ending September 4th, during which several big steerage carrying vessels were due to arrive and were coming fully loaded.

That efficiency and production depend on able management as well as on the work, was emphatically stated by Mr. C. S. Bundesman, superintendant of the piece work department at Hog Island, who states that through his experience with more than 200,000 men, he believes that production requires enthusiasm, and if the proper interest is developed, and labor properly directed and compensated, construction can be increased 50 per cent or more.

He said that before putting into effect at Hog Island, a system of profit sharing, the average cost for labor alone of electrical installation on a ship was from $17,000 to $35,000 and that within a month after profit sharing began, the average cost for this work dropped to $4,000 and has remained there ever since.

Cinder Concrete Blocks for Walls and Pavements

The U. S. Counsul, S. P. Forbus at Brest, France, reports the resumption there of the war suspended business of making concrete blocks with cement and crushed cinders.

These are specially used in pavements, walls, cellar floors and for general construction purposes for which they are cheaper than clay bricks. Interior plaster and exterior stucco adhere well to them, and in the vicinity of Brest they are especially valuable for their resistance to the great humidity that causes brick walls there to drip condensation water.

State and Government Clash Concerning Road Employees

Under the statutes, the Fiscal Court of any county in Alabama may empower overseers of road work to summon any citizens of a county to do road repair work, except citizens of incorporated cities and clergymen. The men cannot be required to work more than two days in one week or six days in one year except in cases of emergency. They are paid at the rate of $2.50 a day, or the work may be accepted in payment of taxes.

A short time ago seven civilian employees of Camp Henry Knox were summoned by the officials of Meade county to leave work at the camp and perform road work. The military authorities contended that the men, being government employees, were exempt from working on county roads. The respective rights of the military authorities and the state in this matter are to be decided by the courts.

Expediting Transportation of Construction Materials

An important help for contractors who are suffering from delayed shipments that are not relieved by ordinary efforts has been provided by the co-ordination of representative construction and material men with the railway leaders.

At the suggestion of Mr. Daniel H. Willard, chairman of the Advisory Council of the Association of Railway Executives, made to Hon. William N. Calder, chairman of the Special Senate Committee on Reconstruction and Production, during his testimony, a committee of representatives of the construction industry in Greater New York has been organized for the purpose of acting directly with the association of Railway Executives in securing the prompt movement of construction material essential to the public interest.

It is believed the work of this committee will go far towards relieving the acute housing shortage in Greater New York. The committee consists of the following:

Dr. J. T. Duryea, president of Pierce, Butler & Pierce Manufacturing Corporation, Chairman; J. H. Burton, president of J. H. Burton Lumber Company; James C. Ewing, president of Goodwin-Gallagher Sand and Gravel Company; J. Sherlock Davis, president of Cross, Austin & Ireland Lumber Company; F. L. Cranford, contractor; C. J. Curtin, president of the Farnam Cheshire Lime Company; T. N. Gilmore, vice-president of the Dwight P. Robinson Company; Calvin Tomkins, President of the Tomkins-Cove Stone Company; C. A. Crane, Secretary Contractors' Association; Ronald Taylor, president Ronald Taylor Company. Headquarters at Room 1605, 29 West 39th Street. Telephone, Vanderbilt 4600.

The committee is prepared to receive applications for assistance in expediting the movement of construction materials from point of origin to destination, in cases where the ordinary routine methods have failed, and where the public interest is at stake.

The committee especially requests that applications be made to it only after the usual methods have failed to produce desired result. The suggestion of the organization of this committee by Mr. Willard indicates the determination on the part of the carriers to use the present facilities of the railroads as far as possible to relieve cases where the emergency is greatest. The committee requests the co-operation of associations and trade journals connected with the construction industry.

John George Leyner

(There are few if any engineers who are so well qualified as W. L. Saunders to understand and appreciate the high character and great engineering and commercial achievements of J. G. Leyner. The following appreciation has been condensed from a memoir prepared from Mr. Saunders' personal knowledge of Mr. Leyner's career and is as inspiring as authoritative.)

John George Leyner, of Denver, Colo., was killed by an automobile accident near Denver on August 5, 1920. Mr. Leyner was an American genius of exceptional ability, a pioneer in rock drilling and mining appliances and an inventor who has contributed much to the industrial progress of his age. No man, in fact, has done as much in the past generation to advance the art of removing rock. Through his inventions the rock drill has passed from the percussive stage, involving machinery of heavy weights, where the rock drill has become a thing but little larger than a pneumatic tool.

To make a rock drill on the piston plan and reduce its weight to a point consistent with practical handling in mines and stopes, to simplify it in its mechanism, and to make it stand up against hard usage, were problems that taxed the best energies of inventors between 1870 and 1900. Henry C. Sergeant came to the front and is the recognized leader in the perfection of the piston type of drill.

Mr. Leyner was the first to attack this system. . . . He advocated and patented the use of the piston as a hammer only, to strike the end of the steel or an intervening medium connected with the steel. He introduced a water jet through the piston into a bit for clearing the hole cuttings. His system patent was taken out in 1903 and his method patent in 1904.

Incorporating the Leyner Engineering Works in 1902, Mr. Leyner built shops at Littleton, Colorado, soon thereafter. Engaged in developing a new and radical principle, he encountered many obstacles, mechanical and financial. . . . For a period of 12 years, in spite of difficulties and successful attacks made upon his drill by the old and leading companies — The Ingersoll-Sergeant Drill Company and the Rand Drill Company, Leyner stuck to his guns, until in 1911 the Ingersoll-Rand Company took over all his patents and inventions, transferred the manufacture to their works at Phillipsburg, and the Leyner-Ingersoll type of drill was from that time a standard. . . . The "Jackhammer," which might almost be placed in one's overcoat pocket, is built on the Leyner principle. This is the most generally used rock drill of today, not only in America but throughout the world. The water Leyner, now known as the Leyner-Ingersoll, is now widely used, displacing entirely the old piston type of drill for mining and tunneling. It holds the world record for fast tunnel driving.

Leyner's other inventions include the drill sharpener, now recognized as the simplest form of sharpener and the one most widely used throughout the world. It has been estimated that this sharpener is used for sharpening about 90 per cent of all the machine-sharpened steel in the world. Leyner also invented the "Little Tugger" hoist used in mines and ship yards. He built the original machines used for producing shredded wheat. His latest invention is the "Linapede" or Leyner Farm Tractor. He was engaged in the development of this tractor at the time of his death.

Mr. Leyner was born in Boulder county, Colorado, in 1860, being the first white child born in that county. He was the son of Mr. and Mrs. Peter A Leyner. He leaves a widow and three adopted children.

A product of the great West, Leyner was a man of strong physique, a worker with his hands and his head, . . . Like most inventors, his main strength was mechanical, though unlike most inventors his vision was laid on practical lines and in advance of conventional things.

The mining industry owes much to Leyner's genius, the world much to the mining industry. To have reduced the cost of removing rock and ore, as Mr. Leyner has done, is an achievement which should place him at the front among America's great inventors.

Chicago's Street Traffic and Pavements

The city council of Chicago has appointed a committee with Alderman Oscar Olsen as chairman to consider what can be done to prevent the destruction of the city's pavement by traffic. Mr. Olsen is quoted as saying that heavy trucks are ruining the streets of the city and that thousands of dollars of damage is being done by them every day. He states that the question to be solved is whether Chicago should "take a backward step by legislating these heavy vehicles from the streets. Would such a stand be a good one for the city to take? Progress demands these rapidly travelling and heavy-capacity vehicles.—Instead of driving them from our streets, should we not rather decide on a more up-to-date and comprehensive plan of future street building that will make our thoroughfares sufficiently strong to withstand the strain of these heavy vehicles?" He believes that the present-day heavy vehicle traffic is reducing the life of the city's pavements by more than 50 per cent. One street is cited which was paved with a surface that was expected to have a life of at least ten years but which was practically destroyed in two years.

Under such conditions, it is of course imperative that something be done. We suggest whether, in adapting pavements to this heavy truck traffic, the trucks should not at the same time be required to confine themselves to the use of certain designated thoroughfares in order that the heavier and consequently more expensive pavement may be confined to these thoroughfares. If this could be done it would probably reduce the number of streets which must receive the heavy pavement by at least 75 per cent.

The preparation of a city plan for Dubuque, Iowa, is urged by city manager O. E. Carr, mayor James Alderson, and commissioner Louis Brede.

Recent Legal Decisions

CONTRACTOR ON COST PLUS MUST EXERCISE GOOD FAITH

The New York Appellate Division holds, Title Guarantee & Trust Co. v. Pam, 182 N. Y. Supp. 824, that a contract to do work upon a basis of cost plus a stipulated commission, does not mean that the contractor has a right to expend any amount of money he may see fit upon the work, regardless of the property, necessity, or honesty of the expenditure, and then compel repayment by the other party, who has confided in his integrity, ability and industry. While statements as presented by the contractor may make out a prima facie case of its right to recover the amount shown thereby, accompanied by vouchers and proof of payment, proof may be introduced to completely destroy the value of the statements and vouchers and open the question as to what was the real cost of the work, honestly, efficiently, and properly done. In an action on notes for work done, given to a contractor under an agreement that there should be no waiver of the maker's right to investigate, and that overcharges should be deducted, the evidence was held to establish reckless and fraudulent expenditures by the contractor's employees, and that the reasonable value of the work was approximately $70,000, instead of about $130,000, as claimed by the contractor and therefore the defendant was entitled to a deduction of about $50,000.

SURETY LIABLE TO CONTRACTOR FOR LACK OF REASONABLE CARE TO MIMIMIZE COST OF COMPLETING CONTRACT

A contractor, O'Kelley, contracted with a city to construct a wharf and dock, executing surety bonds to secure performance. After he had partly performed, the city canceled the contract, upon the ground that he was unable to complete it because of financial embarrassment. The surety was notified and elected to complete the contract in order to protect itself. O'Kelley subsequently sued the surety for $12,608.35, the difference between the amount received by the surety from the city and the reasonable cost of completing the work; and for $3,500 as the value of tools and implements belonging to him which the surety used in doing the work.

Judgment for the contractor was affirmed by the Texas Court of Civil Appeals Lion Bonding & Surety Co., v. O'Kelley, 220 S. W. 1115, for the following reasons. Assuming that the surety company had the right to take over and complete the contract, it did not follow that the contractor then had no further interest in its fulfillment. He was still liable personally for its performance according to the original terms. The defendant's right to undertake its completion was that of a surety acting for its own protection. In a lease, when the surety undertook to complete the contract, it became an agent or trustee for the contractor. It owed him the duty of using reasonable economy and ordinary care and diligence in the performance of that trust. Had the surety elected to leave the work done under its own immediate supervision, it would have been its legal duty, not only to proceed in good faith in the execution of the contract, but to exercise reasonable care and economy in the purchase of material and the employment of labor. The surety did not escape that duty by letting the contract to construction company. It could not arbitrarily agree to a sum for the completion of the work regardless of the conditions under which the contract was made. If the contractor's allegations were true, the surety failed to exercise the proper degree of care, diligence and economy in letting the contract to the construction company, and the evidence was such that the jury might have concluded that the surety carelessly let the contract to the construction company, not only for more than it was reasonably worth to perform that work, but for more than it could, by the exercise of reasonable diligence, have secured a contract for that purpose. There was evidence showing that other competent contractors, had they been given the opportunity, could and would have completed the work for several thousand dollars less than the amount, which the surety agreed to pay the construction company.

GOVERNMENT CONTRACTORS NOT EXEMPT FROM SUITS FOR INFRINGEMENT OF PATENTS

The Circuit Court of Appeals, Third Circuit, holds, Electric Boat Co. v. Lake Torpedo Boat Co., Fed. 670, following the decisions of the Supreme Court of the United States in William Cramp & Sons, etc., Co. v, International Curtiss Marine Turbine Co., 246 U. S. 28, and Marconi Wireless Telegraph Co. v. Sermon, 246 U. S. 46, 38 Sup. Ct. 275, that the Act of Congress of June 25, 1910, giving a right of action in the federal Court of Claims to a patentee whose invention has been "used by the United States without license," cannot be construed as vesting the United States with a general license, nor to entitle a contractor for government work to appropriate a patented invention without liability for its infringement.

SURETY ON IMPROVEMENT CONTRACTOR'S BOND NOT LIABLE ON NONLIENABLE ITEMS

The bond of a contractor on a city public improvement, which undertakes to indemnify the city against any lienable items which would otherwise become a charge against its property, would not ordinarily make the surety liable for any claims against the contractor, although incurred in the performance of the contract, which are not of this nature. Massachusetts Bonding & Ins., Co. v. Chouteau Trust Co., C. C. A., 264 Fed. 793.

NEWS OF THE SOCIETIES

September 13-16—PACIFIC COAST ASSOCIATION OF FIRE CHIEFS. Annual convention Los Angeles, Cal. Secretary, H. W. Bringhurst, Seattle, Wash.

September 13-17—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual meeting San Francisco, Cal. Secretary, A. W. Hedrich, 169 Massachusetts Ave., Boston, Mass.

Sept. 16-18—ENGINEERING INSTITUTE OF CANADA. Meeting to be held at Niagara Falls, Ontario.

September 20-23—SOUTHWESTERN WATER WORKS ASSOCIATION. Annual convention, St. Charles Hotel, New Orleans, La. Secretary, E. L. Fulkerson, Waco, Texas.

Sept. 27-Oct. 21—NATIONAL SAFETY COUNCIL. Ninth annual safety congress at Milwaukee. W. H. Frater, treasurer and business manager, 168 North Michigan avenue, Chicago.

Oct. 12-14—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. St. Louis. 401 Lincoln Avenue, Valparaiso, Ind.

October 13-15—AMERICAN CIVIC ASSOCIATION. Annual convention, Amherst, Mass. Secretary, E. F. Marshall, Union Trust Bldg., Washington, D. C.

October 16-19—AMERICAN COUNTRY LIFE ASSOCIATION. Annual conference, Springfield, Mass. President, Kenyon, L. Butterfield, Amherst, Mass.

Oct. 1922—INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. 25th annual convention, New Orleans, La. Secretary, C. R. George, Houston, Texas.

Dec. 7-10—AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual meeting, New York. Secretary, 29 W. 39th St., New York City.

Jan. 25-27, 1921—THE AMERICAN WOOD PRESERVERS ASSOCIATION. Place of meeting to be announced later.

BRANCHES OF THE ASSOCIATED GENERAL CONTRACTORS OF AMERICA

Akron, Ohio, Builders' Exchange

President, John Clemmer; 1st Vice President, Chas. Cott; 2nd Vice-President, Ray Crisp; Treasurer, U. M. Gill; Secretary, J. Brady; Executive Secretary, Philip P. Gott; Directors, Scott Porter, R. C. Armstrong, H. P. Cahill, Claude Wall, H. S. Clark, W. Pickard, Chas. Akers, T. S. McBrier, W. G. Smith.

Buffalo, Builders' Association Exchange

President, Allan I. Holloway; Vice-President, Joseph J. Feist; Treasurer, Townsend Carpenter; Secretary, Frank N. Farrar.

Chicago, Builders' Exchange

President, John Griffiths; Vice-President, Summer Sollitt; Treasurer, John W. Snyder; Secretary, E. M. Craig.

Chattanooga Chapter of the A. G. C.

President, W. S. Holmes; Vice-President, Baxter Bender; Treasurer, Mark K. Wilson; Secretary, Chas. W. Howard, 523-4 James Bldg.

Cincinnati, Contractors' Association

President, G. E. Jones; Vice-President, Eugene Wagner;, Treasurer Wm. S. Scully, Jr; Secretary, Frank Poling; Executive Board, G. E. Jones, J. M. Quill, A. J. Henkel and D. P. Foley.

Cleveland Chapter of the A. G. C.

President, Jas. R. Gloyd; Vice-President, Chas. H. Strong; Secretary, J. T. Hayes; Board of Control, James R. Gloyd, Chas. H. Strong, A. Lape, C. F. Mullen, and D. W. Sealy.

Louisville General Contractors' Association

President, D. F. Lyman; Vice-President, F. S. DeLand; Treasurer, C. A. [illegible]; Secretary, Geo. A. Brinke.

Memphis, General Contractors' Association

President, F. L. McKnight; Ozane & McKnight; Vice-President, J. E. Faires; Treasurer, J. C. Barker; Secretary, E. W. G. Meers; Directors, James Alexander, J. E. Faires, E. G. Hodges, J. M. Reeves, W. T. Hudson, E. J. Pearson, L. T. Lindsey.

New York City General Contractors Association

President,. Walter J. Drummond; 1st Vice-President, Frederick L. Cranford; 2nd Vice-President, John J. Hagerty; Treasurer, C. Aubrey Nicklas; Secretary, C. A. Crane; Executice Committee, Beaver Engineering & Contracting Co., Borough Asphalt Company, Cranford Company, Emil Diebitsch, Fraser, Brace & Co, Holbrook, Cabot & Rollins Corp, Rodgers & Hagerty, Inc., P. T. Cox Contracting Co., Inc., Degnon Contracting Co., Empire Engineering Co., Inc., John Monks & Sons, Newman & Carey Subway Construction Co., Terry & Tench Co., Inc., Frederick L. Crawford, Inc., Patrick McGovern & Co, Mason & Hanger Co, Inc, North-Eastern Construction Co., Geo. W. Rogers & Co., Smith, Hauser & MacIsaac, Inc., Allen N. Spooner & Son, Inc., Barth S. Cronin Co., F. E. Jones, Stillman-Delehanty-Ferris Co.

Pittsburgh, Pennsylvania Builders' Exchange

President, D. T. Riffle; 1st Vice-President, Geo. T. Heppenstall, 2 nd Vice-President, J. Chas. Wilson; 3rd Vice-President, W. E. Goldman; 4th Vice-President, A. J. Schultz; Treasurer, Eli Abbott; Council, A. W. Forsythe; Secretary, E. M. Tate; Directors, Eli Abbott, H. A. Bloedel, Geo. N. Glass, Keystone Lumber Co., W. E. Goldman, The Barrett Co., Geo. T. Heppenstall, Heppenstall and Marquis; Fred Rebele, Axthelm Electric Co., D. T. Riffle, A. J. Schutz, Schutz, Schreiner and Clyde Co; Ross K. Sefton, S. P. Trimble, W. F. Trimble and Sons Co.; K. J. Chas. Wilson, A. and S. Wilson Co.; Hays M. Junkin, W. S. Miller; A. Q. Starr, Edward Vero.

Philadelphia, Master Builders' Exchange

President, Edwin E. Hollenback; 1st Vice-President, W. Nelson Mayhew; 2nd Vice-President, John R. Wiggins; 3rd Vice-President, Benjamin F. John; Treasurer, Geo. J. Watson; Secretary, Harry C. Woods.

St. Joseph Chapter of A. G. C.

President, P. P. Buddy; Vice-President, Sam Hotchkiss; Treasurer, C. P. Norris; Secretary, E. H. Lawton; Executive Secretary, John H. Vincent.

SOUTHWESTERN WATERWORKS CONVENTION

The ninth annual convention will be held at St. Charles Hotel, New Orleans, Sept. 20-23. A large attendance is expected from the member states, Alambama, Mississippi, Louisiana, Texas, Missouri, Arkansas, Kansas, Oklahoma and New Orleans and from many other parts of the country.

Among the principal subjects presented there will be the following papers and addresses;

Sept. 21, 10 A. M.—Electric Power for Water Pumping—F. D. Maloney, Birmingham, Ala. Efficiency versus Politics—Joe H. Patterson.

Practical talks of five minutes each by superintendents and members of the Association on little difficulties that have arisen in the experience and the method they used for overcoming them. J. F. Christy, W. F. Hale, L. M. Medlenka.

2 P. M.—Water Supplies of the state and their relation toward public health—Jno. H. O'Neill, Sanitary Engineer. State Board of Health, Louisiana. Round Table Talks: It is a paying investment to meter all fire lines. The upkeep of meter and advantages derived by close inspection—Jesse Shaw, B. L. Ulrich.

September 22nd—Standardization of operating and maintenance cost record of water works system—L. L. Ballard. Popularizing Water—R. E. McDonnell.

Round Table Talks:

How can the water works men assist the State Board of Health in Public Health work? Monthly meeting of all employers. The necessity in this day and time to discounting all bills. F. W. Bird, L. M. Medlenka, W. H. Perkinson.

Structural Engineers' Association of Illinois

At the last annual meeting of the Structural Engineers Association of Illinois, Pres. J. G. Giaver stated that the sole purpose of the association is to protect the rights granted to structural engineers under the law and to secure such additional rights and privileges as could be had by later revision of law, to promote the business of licensed structural engineers and create a better public understanding of the importance of the engineers' activities.

He said that solely through the efforts of this association, the revision of the original license law passed in 1915 was secured, giving to all structural engineers license to practice, all the rights and privileges that the association ask.

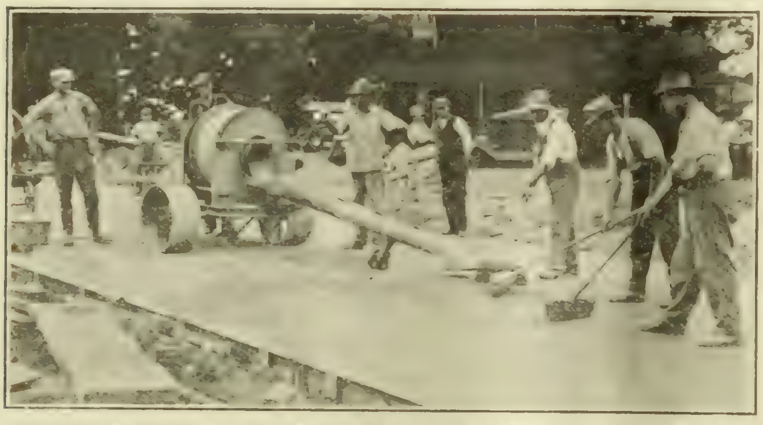
Through the efforts of the association, the Chicago Building Department recognizes the seal of a licensed engineer as equal to that of an architect. Another important achievement was securing a legislative amendment to the general lien law extending full lien rights to structural engineers, and the reduction of the annual fee for the renewal of state licenses from $10 to $1. The practice of structural engineering by one not duly licensed involves a fine and penalty for each day of practice, making such illicit operations extremely unprofitable.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

LAKEWOOD PAVEMENT GROUTER

The grouter mixer manufactured by the Lakewood Enginering Company is adapted to mixing grout for flushing the joints of granite black pavement. It is a small portable machine mounted on a steel truck with two wide-faced wheels and driven by a gasoline engine. Sand, cement and water are supplied by hand and, by the operation of the lever shown in the illustration, the machine discharges into a steel chute with hooded outlet. The chute is pivoted to the truck's frame so that it can be swung to any part of the pavement and is supported near the forward end on a castor so that it can be easily revolved to any position and deliver the grout tothe flushing gang that sweep it thoroughly into all the joints. The machine does the work much more thoroughly and economically than it can be done by hand and save the labor of several men.



FLUSHING GRANITE BLOCK PAVEMENT WITH GROUTER MIXER

BLAW PRUDENTIAL STEEL BUILDING

Catalog 21 of the Blaw-Knox Company describes Blaw-Knox prudential steel buildings formerly manufactured by the C. D. Pruden Company, and for 10 years on the market. After a long and complete investigation of various makes of standardized sectional steel buildings, this type has been selected as giving the most complete service and is now offered, ready for immediate shipment and erection on portable or permanent foundations, adapted to every industrial purposes including light manufacturing, storage and warehousing, machinery housing, bunk houses, power houses, hospitals, truck garages, stockrooms, mess halls and the like.

Among the industrial plant users of Blaw-Knox prudential steel buildings are United States Government Departments, Western Electric Company, several steel and iron companies and many individuals. For construction purposes they have been extensively used for many years by a number of large contractors including James Stewart & Company, Degnon Contracting Company and many others. Many electric and steam railroads, and municipalities use these buildings for freight houses, tool houses, storage sheds, waiting stations and other purposes. Such patrons include the Pennsylvania Railroad, Brooklyn Rapid Transit Company, cities of Pittsburg, Buffalo and others.

The frames of the buildings are made of standard structural steel sections, all shop connections riveted and all field connections bolted. The fabricated sections are designed for a minimum of steel connections and they are standardized, interchangeable and so simple in design that they are easily packed and transported and are rapidly erected by unskilled labor in charge of a competent foreman.

The wall and roof sheets are made of specially pressed galvanized sheet steel in 2-foot widths and the wall sheets, in 8, 10 and 18-foot lengths are bolted top and bottom to the steel framework. The wall studs are made of galvanized sheet metal engaging the wall sheets with an interlocking joint, the roof rafters are similar. The doors have styles and rails of wood covered with pressed steel and may be either swinging or rolling. The windows, hinged either at top or bottom, can be located wherever desired. The buildings can be lined with wood or wallboard.

For industrial purposes, the buildings are from 20 to 50 feet wide and 8 to 12 feet high, made in multiple lengths of 10, 15 and 20 feet. For contractors there is provided a line of standard 20x30-foot bunk houses 8-feet high with a capacity for 16 single or double bunks and type B, 20x50x-8 feet high for 26 bunks. For standard field offices there are the Quixet type 12x20 feet by 8 feet high and the Prudential type 16x30 feet and 8 feet high, while for storage buildings the nine standard sizes vary from 16 feet wide and 8 feet hight to 50 feet wide and 12 feet high in multiple lengths of 10, 16 and 20 feet.

Garages are made in 8, 10 or 12-foot widths, 15 feet, 17 feet 6 inches or 20 feet deep, with or without partitions. Summer cottages are made in 3, 4 and 5-room sizes and can readily be shifted from location to location without the loss of even one bolt.

Convenient, comfortable watchmen's houses are furnished in any length and width multiples of 2 feet 6 inches, with a standard height of 8 feet. Interchangeable doors and windows can be placed wherever desired. A copy of the catalog will be sent free on application.

PERSONALS

Benedict, R. R., formerly assistent superintendent of parks, Kansas City, Missouri, has been appointed assistant state highway engineer, Illinois.

Keith, J. C., has been appointed assistant chief engineer of the Essex Border Utilities Commission with jurisdiction over the water supply, sewerage, and park systems of seven municipalities bordering on the Detroit River.

Andrews, M. O., general manager of the Unit Construction Company, died at Falls River, Mass., Aug. 9.

Miller, W. E., has opened an engineering office in Madison, Wisconsin, for investigations and studies of steam and electric railway and public utility problems, designing, estimating and supervising construction.

Dyatt, A. E., has been appointed resident engineer of Kansas Federal Aid Project 7, Douglas Co., Kans.

Bonar, S. H., has been appointed city engineer of Moundsville, W. Va.

McDermott, J. R., has been appointed assistant division engineer of West Virginia State Road Commission, with headquarters at Keyser, W. Ba.

Miller, W. E., has opened an engineering office in the Pioneer Block, Madison, Wisconsin, specilizing in railway and public utility work.

Sifferlen, C. E., has been appointed instructor in forest engineering at the New York State College of Forestry, Syracuse. New York.

PROBLEMS THAT CITIES ARE STUDYING WITH EXPERTS

The city of Baltimore has appointed a Port Improvements Commission, J. E. Greiner at the head, to govern the expenditure of $50,000,000 authorized by the Maryland Legislature.

It has also appointed a general improvement commission to take charge of the expenditure of $26,000,000 on street paving sewers and other work.

Matthes, G. H., has been appointed assistant engineer of the U. S. Engineer Office at Chattanooga, Tenn., in charge of investigation of the Tennessee River with special reference to water power, flood control and mineral resources.

PUBLIC WORKS.

CITY **COUNTY** **STATE**

A Combination of "Municipal Journal" and "Contracting"

Vol. 49 **FLORAL PARK, SEPTEMBER 18, 1920** **No. 12**

Concrete Lining for Cast Iron Tunnel

Mixing and transporting concrete. Delivered from shafts in pneumatic pipes and in dump cars drawn by locomotives and hoisted above springing line.

The construction of the double track lines of the Rapid Transit Subway System extension across the East River, from New York to Brooklyn, has involved building about 63,600 linear feet of single track tunnels including 14,600 feet of the 60th Street-Blackwell's Island-Queensboro line, 14,200 of the 14th Street-East River-Williamsburgh Line, 11,800 feet of the Old Slip-Clark Street Line, and 13,400 feet of the Whitehall - Montague Street line under the river besides 3,400 feet of similar construction of connecting land tunnels on the Old Slip-Clark Street line and 6,200 feet on the Whitehall - Montague Street line joining respectively the existing original subway in Fulton Street, Brooklyn and the 4th Avenue Subway.

Where the excavation was in sound rock (as in the land portions of 60th Street Line and for a distance of 550 feet under the river on the 14th Street line) the cast iron segmental lining was omitted but in earth and for most of the distance under the river, the cast iron lining was used, giving a total length of about 48,600 linear feet of single track tubes in which the iron lining was used. For all of these rock and cast iron lined tunnels, a total amount of about 155,000 cubic yards of concrete was necessary for lining the tunnels only, and on August 1st, had all been placed with the exception of about 30 per cent of that required for the 14th Street-East River Williamsburg Line.

CONCRETE MIXING PLANT AT FOOT OF SHAFT 7.

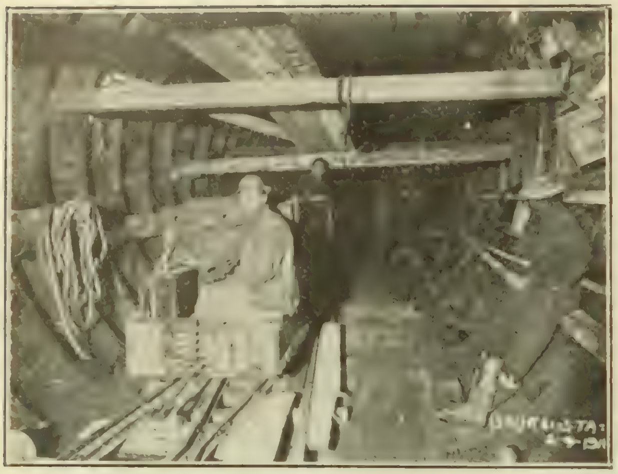
Nominally the concrete was made with a 1:2:4 mixture and was paid at a unit price varying from $9 to $12 a yard.

The concrete was made with graded and mixed aggregate containing pebbles up to 1½-inch diameter, which was shipped by barge, from Long Island, unloaded, stored and delivered to the mixing machines. The transportation and handling sometimes caused so much segregation of the large and small particles of aggregate that it was necessary at times, to add considerably more than the normal amount of cement, thus reducing the advantage of graded aggregate over that mixed at the site.

CONTRACT PRICES

For concrete placed under normal pressure different prices were bid and accepted at different dates.

I. Route 33 Sect 2 let in July, 1914:



ELECTRIC MINE LOCOMOTIVE FOR HAULING MUCK AND CONCRETE

From Whitehall cor. South St. to Clinton & Montague	$12.00
II. Route 48 Sect. 3. let in July, 1914: From Old Slip cor Pearl to about Fulton St. cor. Clark	12.00
III. Route 33 Sect. 3 let in October, 1914: From Clark & Fulton to Fulton & Willoughby-Interboro subway, and from Clinton and Montague to Willoughby and Flatbush Av. Extension	9.00
IV. Route 61. (60th St.—Queens Plaza, let in Aug., 1916.) Included in lump sum.	
V. Route 8 Sect. 3, let in February, 1916: From E. 14th St. & Ave. B. to North 7th St. and Bedford Ave.	9.00

MIXERS INSTALLED AT SHAFTS

The concrete mixing was generally effected at the shafts where the machines were installed below the surface of the ground to permit the delivery of cement and aggregate by gravity from the surface, andthe discharge of the mixed concrete through chutes from the mixer to the conveying plant in the tunnel. Generally the concrete was mixed in Ransome machines of one-half or three-quarter-yard capacity that discharged directly into side dump cars that were hauled on a 24-inch gage track on the tunnel invert by electric locomotives such as were used for hauling out the muck trains.

For the invert the concrete was dumped directly in the bottoms of the tubes, and for the duct benches, side walls and arch, the concrete was lifted in hoists or pulled up inclined planes by air driven hoisting engines that hauled them to traveling platforms at the elevation of the springing line where they were dumped and the concrete shoveled by hand into the forms.

PNEUMATIC CONVEYING

About 5 per cent of the concrete used for the lining was delivered from the mixer to the forms by the pneumatic conveying process using a Ransome-Caniff machine into the hopper of which the mixed concrete was placed. After the airtight door was closed, the valves were operated to force the batch of concrete through the 6-inch pipe under an air pressure up to 100 pounds per square inch and at a velocity up to about 100 feet per second.

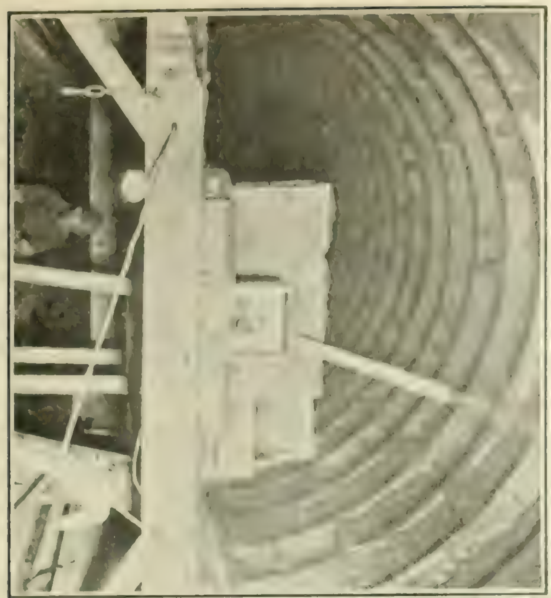
The end of the pipe terminated in a flexible section operated by hand, the end of which was inserted behind the bulkhead or in the form and permitted the concrete to be ejected approximately where required, striking if necessary against a baffle board to absorb the impact. The maximum distance to which concrete was satisfactorily delivered by this method, was only about 500 feet from the foot of the shaft beyond which it was handled exclusively in cars. The difference in elevation between the two ends of the concrete pipe was small and the pipe was carried in a straight line, usually laid on the invert as far as possible from the service track and connected with the compressed air chamber by two long radius bends and with the discharge section by two long radius bends.

The principal wear in the pipe was concentrated on the concave inner surfaces of these bends which rapidly cut through and had to be reinforced or renewed. The advantage of the pneumatic delivery was a considerable saving of construction in the narrow clearance of the tunnel and rapid handling of concrete, but it required a large expenditure of compressed air and the system was liable to irregularity and interruption.

ATOMIZER METHOD

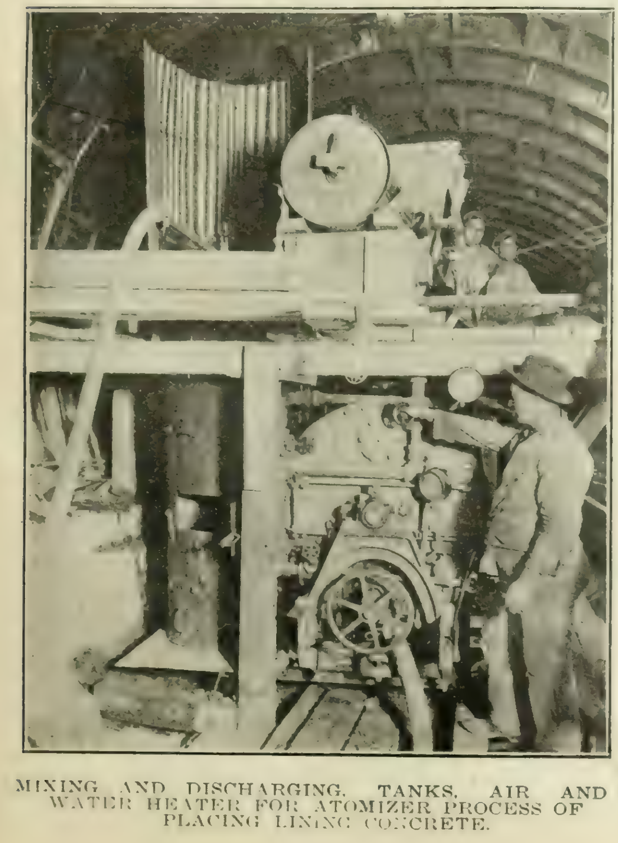
Among the modifications of concrete placing that were experimented with, was the use of the Brow atomizer, a machine somewhat similar to the concrete gun, by which concrete made with small size aggregate and mixed wet was jetted to position by air pressure.

CONCRETING ARCH: CROWN SECTIONS OF LAGGING REMOVED TO PLACE KEY CONCRETE



RADIAL NOZZLE APPLYING CONCRETE TO ARCH RING BY ATOMIZER PROCESS

By this method water was heated in a vertical cylinder shown at the left of the illustration, forced into a receiving tank on top of the platform and mixed with cement, sand and pea size pebbles from the wooden hopper at the right. The hot water, cement and aggregate were delivered by gravity to the discharging tank under the platform where they were thoroughly mixed and ejected under air pressure of about 100 pounds through the 3-inch pipe at the bottom of the machine. This flexible pipe was connected to a revolving radial nozzle mounted on a horizontal longitudinal axis in the center line of the tunnel as shown in another illustration.



MIXING AND DISCHARGING TANKS, AIR AND WATER HEATER FOR ATOMIZER PROCESS OF PLACING LINING CONCRETE.

The machine being put in operation distributed the concrete over the entire surface of the cast iron lining above the springing line when the nozzle was revolved on its axis and moved slowly back and forth in a longitudinal direction, depositing a layer about 1 inch thick with each successive application. In this way the concrete was built up to the full required thickness of 14 inches, making a very solid mass of dense concrete without voids and completely filling the spaces behind and under the ribs, but costing about twice as much as concrete applied in the ordinary manner. The same method was also used to place the concrete in the top of the arch extending about 4 feet each side of the center line.

The atomizer was used for about 200 linear feet of the tunnel but was discontinued because of the excessive time, material and energy required that made the cost prohibitive. Most of the concrete was dumped and shoveled by hand to position. Considerable difficulty was experienced in placing the concrete in the crown of the arch and various methods were tried. The method finally adopted and used on nearly all of the work was that of shovelling the concrete by hand over the top of the lagging on each side of the center line of the tunnel, leaving the crown segments of lagging out until the concrete was brought up on each side to within about 12 inches of the center line of the arch soffit, after which special pieces of lagging were placed to support the crown and the concrete was shoveled in by hand and well ramed in sections about 12 inches long and 24 inches wide.

Water Rates at Erie, Pa.

The water commissioners of Erie, Pa., on October 20 presented to the council two plans for water rates to take the place of the present flat rate system, both of these being based on metering the services. One of these proposes a uniform charge of $6 a year to all classes of consumers as a service charge, and adds to this the charge for water consumed based on the rate of 3 cents per hundred cubic feet for householders, 9 cents for larger users such as small plants and 5 cents for manufacturers.

The other plan proposes a fixed minimum charge of $8 a year, with a rate of 20 cents a hundred cubic feet for residence consumers, 14 cents for the small plants and 5 cents for large manufacturers. It is estimated that the former plan would increase the annual revenue by about $450,000 and the second plan by about $9,000 less. The commissioners favor the first plan.

City Planning for Dubuque

The preparation of a city plan for Dubuque, Iowa, is urged by city manager O. E. Carr, mayor James Alderson, and commissioner Louis Brede, together with other commissioners and citizens. Agitation for a city plan was first started last year by R. M. Plaister, then secretary of the Dubuque Commercial Club.

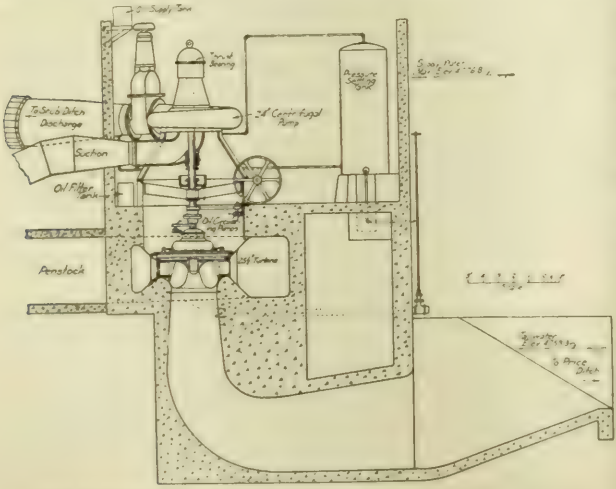
An Efficient Irrigation Pumping Plant

Water for irrigating the Palisade county district in Colorado is diverted from the Grand river through a 5-mile conduit, including a 7,300-foot tunnel and a long canal at an elevation above the feeder canal, and the drop to the latter has been utilized to provide hydraulic head for operating a pumping system for the Mesa county irrigation.

This pumping installation, called the Price-Stub plant, has a 4½ x 4½-foot concrete penstoc delivering to a 25½-inch vertical turbine made by S. Morgan Smith Co., of York, Pa., which is directly connected to a 24-inch special centrifugal pump made by the Byran Jackson Iron Works, Berkeley, Calif. The turbine volute and the draft tube are of concrete, designed for minimum friction. The wood-stave discharge pipe is 30 inches in diameter and 210 feet long. An automatic gravity oil system furnishes a constant supply of filtered oil to the bearings. Special provision was made to protect the moving parts against wear from the excessive amount of silt sometimes carried by the water, and to permit quick and easy replacement of worn parts. A pressure settling tank is provided to supply clear water for the pumping box bearings. All bearings are supplied with detachable bronze sleeves.

The plant was built by government forces. Excavation was made with a dragline machine and concrete was made with sand and gravel hauled by a motor truck 1½ miles through the irrigation tunnel, machine mixed and in freezing weather spouted directly into the forms. The total cost of the pumping plant and appurtenances, including $88,412,22 for hyraulic machinery and installation, was $46,697.83.

The final test, made after the plant had been two months in operation, showed remarkably high efficiency for the range between half-gate opening and full-gate opening. The maximum combined efficiency of the unit was 68.3 per cent at 0.7 gate opening. Separate efficiencies as high as 88 per cent for the turbine and 82 per cent for the pump were indicated, but were not coincident.



PUMPING MACHINERY, PRICE-STUB PUMPING PLANT

The service during the season of 1919 has demonstrated that a plant of this type is efficient, dependable, and economical in operation and maintenance. During the 7 irrigation months, no shut-downs were necessary except for a few short periods to remove sticks and trash from the pump, and only one man was required to handle the plant. At the close of the season, the machinery showed no appreciable wear and was in excellent condition.

New York Municipal Piers

The city of New York has acquired title to more than a mile of waterfront on the east shore of Staten Island in the upper bay extending from Tompkinsville to Clifton, just above the Narrows, and has commenced there the construction of twelve freight piers and slips for ocean traffic. The piers are to be from 125 to 209 feet wide and from 1,000 to 1,160 feet long, separated by slips from about 300 to 360 feet wide and with an ultimate depth of 30 feet. They are substantially perpendicular to the general direction of the bulkhead line and are to be equipped with one and two-story freight sheds and abundant mechanical freight handling devices, and connections to marginal railroads on shore. Part of the dredging has now been done and operations have been commenced on driving the large number of piles required for the piers and timber bulkheads connecting them.

The designs of the piers conform closely to the standards that have been developed by the department of docks. The substructure is supported on long-leaf and southern yellow pine piles spaced about 5 feet apart, except under columns and railroad tracks, in transverse rows 10 feet apart longitudinally, the spacing being reduced to 2 or 3 feet under the tracks and in the clusters of piles supporting the shed columns. The end piles of the transverse rows are diagonally braced above water level and are also braced by spur piles. They have timber caps supporting a heavy reinforced concrete floor slab and concrete piers for the shed columns. The structural steel framework is designed to specifications for high-class bridge and building construction.

In general, the bottom is of hard earth and sand overlaid with 10 to 20 feet of mud and containing some timbers and other obstructions. To secure the required depth of 30 feet in the slips, a large amount of dredging will be required, some of which has already been done. Work is now in progress of driving the piles, of which about 90,000 from 40 to 80 feet long are required. These have all been ordered and are now being received in small quantities by rail and boat, but the transportation is inadequate and different parts of the work are frequently delayed waiting for piles. There is also considerable difficulty in securing enough labor and its quality is not all satisfactory. Wages of $1 an hour and more are paid, but the men shift from job to job and in general are not reliable or so efficient as a few years ago

Most of the piles are being driven with drop hammers operated in floating machines, of which there is one or more installed for nearly every one of the piers. There is also generally installed a floating derrick following each pile driver machine, to handle the caps and braces. Work is commenced at the shore ends of the piers and continued outwards.

On pier 15, which is being constructed by Geo. B. Spearin, Inc., the pile driving is well advanced and the usual method is somewhat modified by the use of a land machine to supplement the floating driver. The floating driver with a crew of 10 men drives the transverse rows complete at the rate of two or more daily and is followed by 20 or 30 stay-lathers who cap and brace the piles. As the rows are only 10 feet apart, their caps provide support for the land driver which follows, driving the clusters of piles under the column piers. For this pier the piles are delivered by railroad cars at the land end, transferred to catamarans, towed out, and floated in the water adjacent to the machine until used. They are lined in, in the usual manner by two rows of rangers attached to piles at the shore end and are spaced by a movable float moored to the last-driven row. The ends are bluntly pointed and they are driven without shoes or water jets at a maximum rate of about 90 per day by one machine operated by the floating machine. This machine drives them so carefully that their projection above the cut-off is very short and uniform, and in a lot of 200 or 300 observed when these notes were taken, none of them varied more than 1 or 2 feet from cut-off level, thus reducing the waste to a very small minimum. They are cut off in the usual manner, at a cost of about 60c each, by two men with a cross-cut saw operated with a pair of guide strips nailed to the piles.

The work is under the direction of Dock Commissioner Murray Hulbert and T. F. Keller, chief engineer. The contractors for the substructure are the Terry & Tench Co.; Smith, Hauser & McIsaac, Inc.; Geo. B. Spearin, Inc.; the Snare & Triest Co.; Barth S. Cronin, Inc.; and the Phoenix Construction Co.

New Jersey to Increase Auto Licenses

It is reported that the legislature of the state of New Jersey which will convene on September 8, will be urged by the State Highway Commission to adopt a bill making substantial increases in motor vehicle licenses. Such a bill was passed by the House at the last session but not by the Senate. It is estimated that the increase proposed would raise $600,000 additional for the use of the Highway Department. The plan is to charge licenses according to the gross weight and carrying capacity of the vehicle, from $7.20 a year for those with a carrying capacity of 1,000 pounds or less, to a maximum charge of $80.40 a year for trucks with a carrying capacity of 20,000 pounds.

Treating the Waste of Packingtown, Chicago

Review of tests and conclusions reached during the past few years, and description of plant decided upon.

In the yards of Packingtown, Chicago, there are killed annually about 12 million head of animals, comprising cattle, calfs, hogs and sheep, with a total weight of about 4 billion pounds. Practically all of the material in the animal is put to some use, less than 1 per cent of it being rejected. This 1 per cent is carried away by the sewers leading from this district. One per cent seems a small amount, but 1 per cent of 4 billion pounds is no insignificant matter when found in sewage, amounting to between 50 and 75 tons of dry solids per day in the sewage from this district and equivalent to the pollution from a population of about one million people.

The treating of this sewage so as to prevent pollution of the channels and streams through which the sewage effluent flows has become yearly a more urgent problem for the Sanitary District. A narration of the means studied and undertaken by the city to meet this problem was given in a paper by Langdon Pearse, sanitary engineer of the Sanitary District of Chicago, before the Western Society of Engineers. From this paper the following facts are abstracted.

Owing to the enormous amount as well as character of the solids in the drainage from this district, it has become absolutely necessary for the city to remove a large part of the suspended matter and further purify the liquid before finally discharging the effluent to flow through the drainage canal and the Illinois river into the Mississippi. The city considered that the packers should stand a large part of the expense of treating the sewage from the Packingtown district, and originally asked them to pay 85 per cent while the sanitary district paid the remaining 15. The packers, on the other hand, thought that they should not be asked to pay more than 40 per cent. The packers finally agreed tentatively to pay 60 per cent of the cost. Some of the civic organizations thought that the public should not pay more than 15 per cent but finally agreed to the 40 per cent as a compromise. There appeared to be no precedent for reaching a decision in a case of this kind, nor any established rule by which the equity of the problem could be worked out along exact or mathematical lines.

On the scientific side, study of the method of treating the sewage was begun seriously in 1911. With the cooperation of the packers, who paid $2,500 toward the cost, a testing station was established and run for two years. The sewage was studied and it was found that its strength was about eight times as strong as the average sewage from the rest of the city.

A grit chamber was used to study the removal of grit and fat. There was not much grit, but the chamber removed at times as much as 1,000 pounds of fatty scum per million gallons, although when the weather was warm and other conditions contributed, the amount might fall to 5 pounds. Much more grease was collected in cold weather, when the temperature of the sewage apparently fell below the melting point of the grease.

For sedimentation, Imhoff tanks were used and removed from 60 to 70 per cent of the suspended matter. Chemical precipitation, using iron and lime, removed from 3 to 6 and sometimes 8 cubic yards of sludge per million gallons, the sludge having a very bad odor. The effluent was treated on a filter at the rate of ½ of a million gallons per acre per day. A rotary screen covered with 30-mesh wire was tested and was found to remove from 500 to 1000 pounds of dry material per million gallons. The effluent, when passed through a settling tank, deposited about three times as much as this in the tank, showing that the fine solids which were not intercepted by the screen greatly exceeded the coarse solids in volume. However, in the report made in 1915 the engineers recommended that the sewage be passed through fine screens, followed by tanks and possibly by sprinkling filters, feeling that the screen was beneficial and should be used.

EXPERIMENTS WITH ACTIVATED SLUDGE

A few months after this report had been prepared, the activated sludge process began to attract attention abroad and the substituting of this for sprinkling filters was tried in an experimental plant. This plant was operated for about two years, consisting of a rotary screen 30-mesh (20-mesh being substituted later) and an activated sludge plant. At first the sewage was aerated with the sludge, but later they tried reaerating the sludge on its return to see if there were any economy in this. It was found that the amount of air could be reduced and also the space required for the tanks. Apparently about 12 per cent less area was needed for the tanks, but the complication of the process was increased.

After aerating, the sewage was passed through settling tanks, of which different types were tested. The Dortmund tank, in which the sewage enters near the center and flows outward to the circumference, gave better results than a straight-flow tank. An inclined tank gave by far the greatest efficiency but would be rather expensive to build. The engineers favor for the actual operating plant the use of a Dorr tank, which is a shallow circular tank in which sludge is slowly pushed toward the center by squeegees in a given number of hours, according to the design, when it can be pumped out.

The activated sludge process gave the best removal of suspended matter and the clearest effluent of any of the processes tried. From 80 to 90 per cent stability was secured in the summer and from 30 to 60 per cent in the winter. The removal of suspended matter was high and the actual sludge removed totaled 85 to 90 per cent of the suspended matter removed; the suspended matter being the solids taken out of the sewage and the sludge being the solids as removed from the tanks. This is considerably closer than has been found in other experimental work and showed that there was very little digestion of the sludge in these particular tanks.

Having practically settled upon the theoretical principles of treatment, the actual designing of a plant was undertaken by Mr. Pearse, representing the district, and W. D. Richardson, chief chemist of Swift & Co., representing the packers. They recommended an intercepting sewer to keep the Packingtown sewage separate from the rest of the city's sewage. The former would then contain the waste from the packing houses and the domestic sewage from the employees living in the district. A survey of the situation indicated that it was not worth while to endeavor to separate these two kinds of sewage. This intercepting sewer would lead to an area of 8 acres owned by the district at the intersection of the east and west arms of the south fork of the south branch of the Chicago river. The smallness of the area available probably would increase the cost of the plant. Another site, however, was available, and at the time Mr. Pearse presented his paper the question of site had not been decided, being deferred partly because of legal complications.

The plant in general would consist of fine screens, a combined grit and grease skimming chamber, an aeration tank, and a settling tank. There would also be filter presses for reducing the water content of the sludge from 98 or 99 per cent down to 75 or 80 per cent, and rotary driers in which the moisture could be reduced to 10 per cent, permitting the use of the sludge cake as commercial fertilizer.

In designing the plant the period of contact was taken as 8 hours, 4 cubic feet of air was provided per gallon of sewage, and the settling tanks were designed for one hour of sedimentation.

This was the condition when the war interfered with any further development of the proposition. Mr. Pearse suggested that the plant, when begun, could be constructed and put into use progressively. Thirty-mesh screens, for instance, could be built quickly and be ready when the intercepting sewer was completed, and be operated until the rest of the plant had been built up to its full capacity.

The cost was estimated in 1917 at 3½ million dollars for construction and $850,000 a year for operation, interest and depreciation. Of the operation cost, $207,000 was for electrical current at the rate of .7 cents per k.w.h., a great amount being required for furnishing 4 cubic feet of air per gallon of sewage. The labor cost was estimated at $100,000. It was believed not only by the engineers of the Sanitary District but also by the packers that the sludge which could be recovered had a commercial value, Mr. Pearse saying, "I think that was the reason, largely, why the packers, for the first time in their history, agreed that a sewage treatment process was practical and assented to activated sludge. The district had a great deal of difficulty in interesting them in other processes, even though the experimental plant had demonstrated what was practicable. The dried sludge apparently has a sale value sufficient to offset a part of the operating cost, say $200,000 to $400,000 a year. This would not by any means pay the cost of operating, including interest and sinking fund, but it would more than pay the cost of recovery of the sludge. There is also some return in the way of grease, but this is difficult to estimate because of the varying amount of grease that is recovered. It amounts, however, to about $20,000."

Land Platting in Akron, Ohio

Rules and regulations adopted by the City Planning Commission governing the platting of land and approval of allotment plats. Regulations and suggestions concerning tree planting.

The City Planning Commission of the City of Akron, Ohio, on June 15, 1920, adopted as its standard requirements certain rules and regulations governing the platting of land and the approval of allotment plats within the jurisdiction of the commission. Somewhat abbreviated by substituting informal for formal statement, these regulations are as follows:

PRELIMINARY PLANS

A preliminary street plan shall be submitted to the commision and be tentatively approved by it before the allotter will be authorized to proceed. The scale of this plan is optional but it must show contours, all trees over 8 inches in diameter, water courses, property lines and other existing features, show the acreage, proposed minimum width of lots and the name of the allotter. It must be accompanied by a vicinity plat showing existing streets in the surrounding territory.

GENERAL REQUIREMENTS

Major or traffic streets shall be not less than 60 feet wide, and the commission may require 70, 80, or 90 feet, or more. Minor or residence streets shall be 50 feet or more in width.

The street corners shall be rounded with a radius of not less than 5 feet.

All streets shall be co-terminous with existing streets at the same or greater width, unless a variation be deemed advisable by the commission.

Cross streets shall be located at intervals of not more than 600 nor less than 400 feet, except where the commission deems existing conditions justify a variation from this.

Grades shall be the flatest possible, but none shall exceed 5 per cent on traffic streets or 10 per cent on residence streets.

No residence lot shall be less than 45 feet wide. Corner lots shall be of sufficient width to permit a side street set-back restriction of not less than 15 feet. All side lines of lots shall be at right angles or radial to the street lines, unless a variation from this will give a better street and road plan. The engineer of the commission will take all levels for street profiles and establish all grades, charging the cost to the allotment owner. He will also check all boundary surveys on the ground after the preliminary plat has been approved by the commission, charging this also to the owner. Before this survey will be made, a print must be filed with the commission showing all survey points, lines and angles as found on the ground and also as given in the deeds, iron rods or pipes being set at all boundary corners.

The owner must set monuments at all boundary corners and all street intersections, as indicated by the planning engineer, the tops of the monuments to conform to the final grade of the sidewalk or pavement. If these have not been set when the plat is accepted, the owner must deposit with the commission a certified check estimated by it to be sufficient to cover the cost of setting said monuments, this check to be returned after the monuments have been set. Unless they have been set within three months after the expiration of the time limit fixed in the bond for the grading of streets, the commission or the city may set the monuments with the proceeds of the check.

The owner shall also give a bond to guarantee grading of new streets and public places, laying 6-foot cinder walks, erecting street signs and providing drainage satisfactory to the engineer of the commission; also for improving such streets as the commission may require and at least one street that will provide access to the allotment from a street that has an existing improvement.

Trees shall be planted of a size and variety and in the location prescribed by the commission and a bond furnished to cover the cost of maintaining the trees for a period of two years.

Storm drains will be required where deemed necessary.

The minimum set-back or building line shall be 15 feet from the street line, but more than 15 may be required where depths of lots and neighborhood conditions warrant it.

Easement not less than 10 feet wide, 5 feet on each side, for public service poles, pipes, conduits, etc., will be required along the rear of lots and in other locations where necessary. The owner must also furnish a copy of his form of sale contract showing restrictions.

In residential allotments the commission will require the allotter to dedicate for play grounds an area which it deems adequate. An abstract of title or other evidence satisfactory to the Director of Law, showing good title, must be furnished the commission.

The commission must also approve of the use to be made of the property as that for which it appears to most appropriate and suitable.

RECORD PLATS

Record plats shall be prepared on a scale of 50 feet to 1 inch and on sheets 24 inches by 26 inches, a plan map on a smaller scale being filed also when more than 1 sheet is needed. This map shall show names of adjoining owners; lengths of tangents, radii, arcs, and chords and central angles for all street curves and corners; chord lengths, arcs, and central angles for frontage on each lot on curves, and all interior angles for every lot. The commission's engineer will check this print, charging the cost to the allotter. The record print will then be the property of the planning commission.

In addition, the commission requires that there be placed on this plat notations of such building regulations of the commission as may be appropriate. For instance: "On residence lots, all residences and other structures more than 15 feet in height shall be placed not less than 7.5 feet from each side line of the lot; and no part of the structure, such as porch or steps, shall extend beyond the building line." Some of the other requirements are that no barn or separate out-building is permitted on a corner lot of less than 15,000 square feet area, although a garage may be built as part of a residence on a smaller lot. The print must state the date by which the streets will be graded to the full width, grade and cross sections established, and when the street signs will be placed.

The commission suggests that the following clause be placed on the record tracing of residence allotments to assure a proper development: "For a period of 25 years hereafter, no dwellings shall be erected or maintained on this allotment to accommodate or make provision for more than 10 families on any acre of land, exclusive of street, nor more than a proportional number of families on a fractional part of any acre of land."

According to the charter of the city of Akron, the planning commission, is "empowered to make plans and maps of the whole or of any portion of the city and also of any land outside the city within a distance of three miles beyond the limits of the city. No plan or plat subdividing the land within the city limits or within three miles beyond the city limits shall be entitled to be recorded in the office of the recorder of Summit county without the approval of the planning commission."

SHADE TREE PLANTING

At the same date the commission adopted regulations that all street trees planted within three miles of the city limits must be approved by the commission or its representative and be planted according to certain specifications which it gives in detail.

The only kinds of trees permitted will be one of the following: Norway maple, Sugar maple, Buckeye, Hornbeam, Hackberry, Maidenhair, Honey locust, Oriental plane, European linden, Red oak, Pin oak and American elm. The commission especially prohibits the Silver maple, Ash leaved maple, Tree of Heaven and Poplars. Where the distance between building lines is less than 75 feet it advises the use of either the Hornbeam, Hackberry, Maidenhair, Honey locust or Pin oak.

Trees must be at least 1½ inches in diameter one foot above the ground when planted. The lowest branches shall be between 7½ and 9½ feet above the ground.

Intervals between trees must be at least 40 feet. They may be spaced either opposite or staggered but should be planted in definite relation to each other. No tree shall be less than 18 feet from a curb corner.

Where practicable, present and probable future approaches to dwellings and garages shall be considered in locating trees.

The desirable minimum width of planting strip between curb and sidewalk is 5 feet, and wider if conditions permit.

April, May, October and November are the best planting months. If the soil is not favorable, not less than 2 cubic yards favorable soil shall be placed around each tree planted.

Trees should be mulched and artificially watered for at least two years after planting. Attractive tree guards should be used to protect the trees against mutilation and other injury. Trimming or removing trees shall be done only with the approval and under the direction of the commission.

The commission states that the variety of tree and other requirements and suggestions are all based upon local conditions, which may not apply to other localities. Certain trees, however, are prohibited because of undesirable growth, including the clogging of sewers with roots, the heaving of sidewalks, brittleness of branches, and short lives.

Salt for Dust Laying

The city officials of Elmira, N. Y., announced a few days ago that they expected to use salt for sprinkling the roads in place of the oil which they had wished to use but which the city found itself unable to buy. Unrefined salt will be purchased, presumably from Syracuse, and used in the sprinkling wagons for this purpose.

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Tunnel Lining

In sound dry rock, tunnel lining may be, like the snakes in Ireland—minus. In other dry material they may be designed simply to protect the excavation from falling roofs and walls, easily constructed and of a great variety of types and dimensions. In soft materials, generally encountered in shield driven tunnels, the lining has several important functions including the protection of the roof, sides and bottom, the exclusion of water, resistance to heavy and sometimes unbalanced external pressure, sometimes resistance to bending moments, and aften temporary resistance to internal air pressure.

These requirements, although they may be approximately met by a simple sectional steel or iron shell, and to a greater or less degree by simple brick or concrete linings which have been used satisfactorily, are generally provided for by a compound shell composed of cast iron segments heavily lined with monolithic concrete strong enough to reinforce the more costly cast iron, provide against the ultimate possible deterioration of the latter, insure more perfect water tightness and provide a smooth and regular interior finish.

The construction of such a lining is generally an elaborate, slow, and costly operation beginning with the rapid assembly of the cast iron sediments within the shields, followed by exterior packing or grouting to reduce and equalize external pressure. The application of the comparatively thin concrete lining to this shell which must generally be done as rapidly as possible and without obstructing other operations in the long and very narrow limits of the tunnel, presents many difficult and expensive features some of which will be described on page 247 and in subsequent articles.

The work there referred to includes recent construction on several miles of subaqueous single track railroad tunnels, executed with the best skill and experience and equipment available, and may be taken for the most advanced practice and development in this class of work.

The outstanding features are the mixing of concrete in the shafts; transportation in electric hauled dump cars and within limits by pneumatic process; the use of short units of collapsible steel forms combined in long sections and mounted on traveling steel towers permitting traffic through them; the hoisting of concrete at the forms; placing a small quantity of it by the atomizer process without forms; and the grouting of the concrete lining itself within the iron shell.

These processes have all been developed to a practical efficiency that reflects great credit on the engineers and contractors who designed and executed the work under many difficulties including labor troubles, and is depended on for permanancy and thorough reliability. Future work possessing probably the same characteristics may be modified by improvements in the details, methods and appliances such as are always in line to expedite work and reduce cost.

Treating Unusually Strong Sewage

Information has appeared from time to time during the past few years concerning the experiments which have been made in treating the sewage from Packingtown, Chicago, which is unusually strong, containing large amounts of waste from the packing houses in addition to the domestic sewage of the workmen living in that district. The summing up of these tests and the conclusions from them by Mr. Pearse, who has been connected with the investigations from the beginning, is exceedingly interesting, bringing up to date as it does the results of these experiments. Mr. Pearse's resume is abstracted in another part of this issue.

It will be noted that the engineers kept well abreast of progress in the art of sewage treatment in their investigations, being among the first in this country to make practical tests of the activated sludge method. They found that this process gave a better removal of suspended matter and a clearer effluent than did the Imhoff tank or any other tank process tried. They concluded, however, that it was advisable to pass the sewage through fine screens before subjecting it to tank treatment. The final plant was designed to consist of fine screens, a combined grit and grease skimming chamber, a modified activated sludge treatment, and a final settling tank; with filter presses and rotary driers for reducing the sludge to commercial fertilizer.

Not the least interesting feature of the report is the statement that the packers appeared to be convinced that there was commercial value in the sludge recovered by this process, to this being attributed a considerable part of the success that the city had in enlisting their co-operation in solving the problem.

Road Work For Winter

About nine months ago this paper urged contractors and road authorities to prepare for the summer's construction program by getting their plant in order, arranging for contracts, and so far as possible distributing the stone, gravel and other materials which would be needed in the construction.

Similarly, as the close of the construction season approaches, we urge that consideration be given to preparation for the winter season. Where contracts are holding over to next year or have been let for next year's work, or where the work is being done by day labor by highway authorities, much can often be gained not only in time but in saving of cost by planning to do a large part of the hauling through the winter. And such planning, if the best part of the winter is to be used, means laying plans during the next few weeks and arranging for the necessary men and implements, trucks and other vehicles, etc.

Where roads are apt to be soft in spring, the best season for hauling heavy loads is during the cold winter weather when the roads are frozen hard. Moreover, it is frequently possible to save long detours by hauling directly across swampy or boggy land when this is frozen in the winter and covered with a foot or two of snow.

Actual experiences in winter work of this kind in the northwest are described in this issue and many suggestions may be obtained by those engaged in roadwork whereby it may be possible for them to do winter hauling at a great saving in cost. Another advantage is that, by providing work through the winter, foremen and some of the most desirable laborers can be retained on the payroll at no loss to the contractor, and horses will not be eating their heads off in idleness, as is so often the case during the two or three coldest months.

Proposed Dam at Windsor Locks

The recent creation of a Federal Water Power Commission has been followed very quickly by numerous applications from all sections of the country for permission to establish water power plants. Among these is an application recently filed by the Connecticut River Company to dam that river at Windsor Locks. The dam would not only provide power but, in connection with it, there would be locks and canals which would make navigable a considerable stretch above the dam which is not now available for boats of large dimensions.

The locks proposed to be constructed in connection with the dam would accommodate boats 380 feet long, 60 feet beam and 40 foot draft, and it is said that this would permit boats of this size to ascend the river to Springfield and Holyoke. The power plant would generate an average of 40,000 horsepower. The plans for this improvement were approved by government engineers a few years ago, at which time it was estimated that the cost would be about $4,000,000 Probably present prices would make the cost double this.

The completion of the river navigation plans would call for a movable dam further down the river with a lock around it, and a canal through the flats at East Hartford in order to get around the Hartford bridge.

Rats in Portland's Dump

Commissioner Mann, under authorization of the Portland city council, wants the aid of someone who can kill the thousands of rats that infest the refuse dump adjacent to the municipal incinerator.

Incinerator superintendent Belbert reported to the council that more rats now inhabit the dump than ever before.

Commissioner Mann visited the dump recently and found the rats so numerous that beaten paths had been formed, winding from the top of the dump to entrances to the homes of the rodents.

Persons living near the dump and employes at the incinerator say the rats frolic there every night, sleeping in the daytime, and that scampering over empty cans at night they make noise enough to disturb the sleep of people living nearby.

The superintendent of the incinerator said the recent dumping of thousands of rotted watermellons brought joy to the rodents, for ordinary there is little food on the dump and the rats are kept busy in their search for sustenance.

A few days ago Commissioner Mann purchased a virus, which was used in ridding Washington park of rats, being sprinkled on food thrown out for the rodents. The park bureau was unable to purchase this poison last year and the commissioner now is making an effort to locate enough of it to rid the dump of rats. Failing this, he will try some other plan.

Designing Aqueduct of Winnipeg Water Works*

Types of inverts used, after testing different types to destruction, and after constructing part of the line. Effect of alkali soil.

TYPES OF INVERTS USED

The standard invert used throughout during the 1915 construction program and until April, 1916 was, in form, a concrete slab as wide as the extreme spread of the feet of the arch, from outside to outside, with a curved upper surface struck to a radius of 14 feet for the aqueduct 9 feet high (the largest size used), and 8 feet 1¼ inches for the aqueduct 5 feet 4¾ inches high, (the smallest size used).

The slab was 6 inches thick in the center and for a certain distance each side, then built on a uniform flat slope to the full width required, and was laid in 15-foot lengths, with a crimped copper expansion joint between each two adjacent slabs, in advance of and to form a footing for the arches.

During the first year's work it was next to impossible to get the contractors' men to properly consolidate the foundation along the edges of the trench, particularly where the soil was of clay, the temptation being strong to trim the surface to the exact grade required with sharp shovels, which cut it like cheese and left a fine surface for the concrete. This operation, however, left the top surface uncompacted and capable of considerable compression under moderate loads, and a large percentage of the fine cracks in the invert were due to this fact.

Finally it was required that all compressible clay sub-grades, particularly in shallow cuts and where the trench was moist or wet, should be covered with a thin layer of gravel, to be heavily hand-rammed for a width of about three or four feet along the outside edges. When it is realized that a deflection of only about one-thirtieth of an inch would cause cracks in the inverts, the reason for a hair-line crack along the center of the invert when the back fill was put over an arch is easily understood, where the sub-grade was simply trimmed with a shovel. The uncompacted soil would at times exhibit that much compression under loads of only 700 pounds per square foot, or about 5 pounds per square inch. Rolling these sub-grades, even under planks on a gravel bed, was impracticable; it would jelly below the surface and work into waves ahead of the roller; hand compacting by heavy rammers on a thin bed of gravel seemed to be the best means of getting hard enough bottom; and when this was done properly and conscientiously, as it was after the first season's work had shown the contractors and inspectors the results of laxity in this regard, the hair-line cracks from this cause were practically eliminated.

The large cracks were due to a different cause—the compressibility of the soil by greater amounts; and the only way to avoid these cracks was to reduce the unit pressure under the arch footings by spreading the invert to a greater width, or to thicken and reinforce the bottom of the aqueduct so as to distribute the pressure over the whole bottom width of the invert, as uniformly as practicable.

TESTING DIFFERENT TYPES OF INVERT TO DISTRUCTION

In order to have something more than theory as a guide relative to the actual distribution of pressure over the bottom of the aqueduct, to aid in proportioning the inverts for this condition of soil, a series of full size inverts for the 8 feet 9 inches x 7 feet 4⅝ inches aqueduct, made 2 feet in width and laid parallel to each other on the natural soil trimmed to shape, was built at Deacon. There were in all 6 inverts, as follows:

A1, A2, and A3. Standard inverts 6 inches thick in the middle as used in all aqueducts prior to April, 1916.

B. Standard invert with three wood strips ⅝ x 1½ x 24-inches built across the invert in the center and near the ends, where cracking had occurred in the construction work.

C1 and C2. Standard inverts 6 inches thick at center with 12-inch extension on each end, making the out-to-out width 14 feet instead of 12 feet as in the original inverts for this size of aqueduct.

D1, and D2. Standard inverts 6 inches thick reinforced with ½-inch bars 8 inches.

E1, and E2. Standard inverts 6 inches thick reinforced with ⅝ inch square bars to c.

F1, and F2. Standard inverts 7½ inches thick reinforced with ⅝-inch bars 8 inches to c.

G1, and G2. Invert of standard width, but 10 inches thick, reinforced with ⅝-inch square bars 8 inches to c.

H. Invert of standard width, but 11¼ inches thick, reinforced with ⅝-inch square bars 4 inches to c.

K. Standard invert 6 inches thick reinforced with ⅝-inch square bars 4 inches to c.

These inverts were built in the regular way and were provided with concrete pedestals about 2 feet high on each side, of the width of the sides of the arches. The loading was done by laying 60-pound steel rails across the tops of the two pedestals and observing the settlement of the invert at each side, at the middle, and at the quarter points, as the load was increased. The deflections, or settlements, as reported, were measured with accuracy below a fine bronze wire stretched tightly across, from posts driven deeply into the ground each side of each test invert.

The load and the deflection at each point were recorded as each crack appeared, and from these records a number of important deductions were evident.

For instance, in inverts C1 and C2, cracks did not appear until the load carried was as great as

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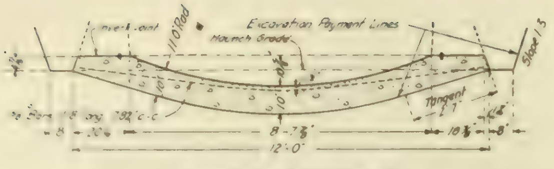
**Continued from Page 236.*



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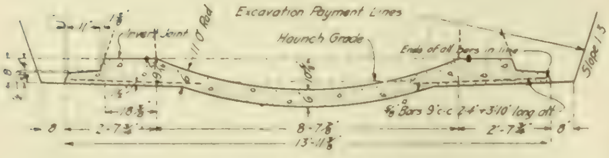

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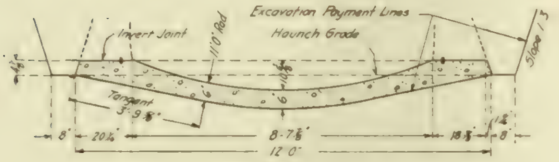
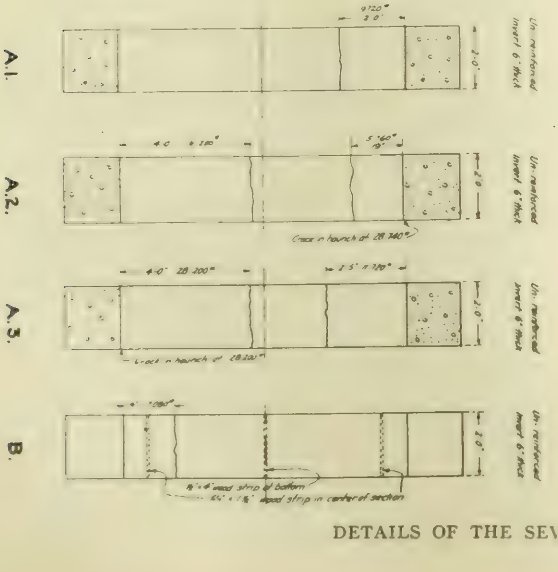


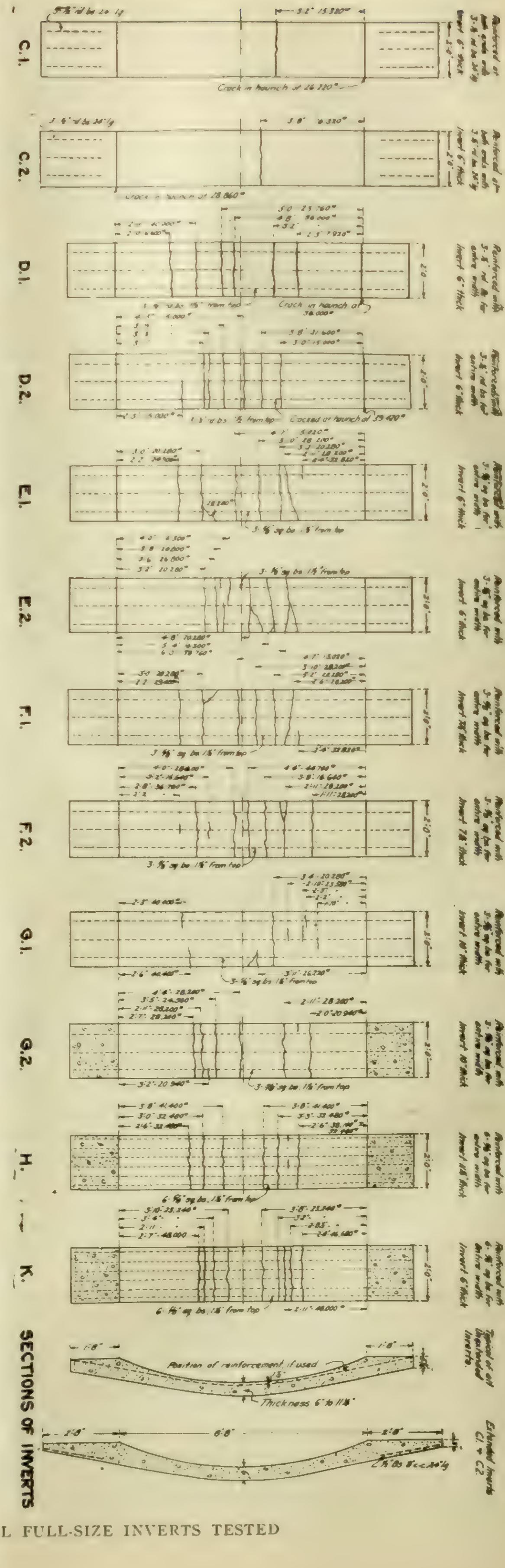
SECTION LETTER BO

that required to produce the first cracks in inverts F1 and F2, which were 1½ inches thicker than C1 and C2; and in addition were reinforced with ⅝-inch square bars 8-inches. In fact, those two thin, reinforced inverts carried a greater load, without a crack, than any other except those which were heavily reinforced and nearly twice as thick.

There was, however, this important difference, that by the time the test load had reached an amount equivalent to the actual load due to the aqueduct and its backfill and water load, a little over 5,000 pounds per side per foot, the inverts C1 and C 2 had shown but one crack each, in the center, and the load had to be increased by 50 per cent. to cause the second crack to appear at the edge of the invert in each case.

Reinforced inverts D1, D2, E1, E2, F1 and F2, showed from two to six cracks under the same


A.1.
Un-reinforced invert 6" thick
A.2.
Un-reinforced invert 6" thick
Crack in haunch at 28,740"
A.3.
Un-reinforced invert 6" thick
Crack in haunch at 28,200"
B.
Un-reinforced invert 6" thick
Wood strip at bottom
Wood strip in center of section


C.1.
Reinforced at both ends with 3-⅝" rd bs 24" lg. Invert 6" thick
Crack in haunch at 26,220"
C.2.
Reinforced at both ends with 3-⅝" rd bs 24" lg. Invert 6" thick
D.1.
Reinforced with 3-⅝" rd bs for entire width. Invert 6" thick
Crack in haunch at 36,000"
D.2.
Reinforced with 3-⅝" rd bs for entire width. Invert 6" thick
Cracked at haunch at 39,420"
E.1.
Reinforced with 3-⅝" sq bs for entire width. Invert 6" thick
3-⅝" sq bs ⅛" from top
E.2.
Reinforced with 3-⅝" rd bs for entire width. Invert 6" thick
3-⅝" sq bs 1⅛" from top
F.1.
Reinforced with 3-⅝" sq bs for entire width. Invert 7½" thick
3-⅝" sq bs 1⅛" from top
F.2.
Reinforced with 3-⅝" sq bs for entire width. Invert 7½" thick
3-⅝" sq bs 1⅛" from top
G.1.
Reinforced with 3-⅝" sq bs for entire width. Invert 10" thick
3-⅝" sq bs 1⅛" from top
G.2.
Reinforced with 3-⅝" sq bs for entire width. Invert 10" thick
3-⅝" sq bs 1⅛" from top
H.
Reinforced with 6-⅝" sq bs for entire width. Invert 11½" thick
6-⅝" sq bs 1⅛" from top
K.
Reinforced with 6-⅝" sq bs for entire width. Invert 6" thick
6-⅝" sq bs 1⅛" from top
SECTIONS OF INVERTS
Position of reinforcement if used
Thickness 6" to 11½"
Typical of all experimental inverts
Extended inverts C1 & C2
6'-8"
2'-8"

DETAILS OF THE SEVERAL FULL-SIZE INVERTS TESTED loading as C1 and C2; and even G1, G2 and K showed two to five cracks across the surface before the load reached the amount normally to be carried by the arch. In other words, the only reinforced invert that demonstrated its superiority to plain, thin inverts C1 and C2 with an extended base, was invert H, which was twice as thick (11¼ inches) and also reinforced with ⅝-inch square bars 4 inches to c.

Furthermore, the cracks in inverts C1 and C2 could be repaired and the result be made as good as the originals, while the reinforced inverts could not be repaired except at much greater cost, owing to the multiplicity of cracks, and at the risk of further disintegration if acid soil water should penetrate to the steel from below.

To prevent further cracks in the invert, a change was made, early in 1916, by adopting for all solid ground, regardless of whether it were compressible or not, a standard invert 6 inches thick at the center, with an 8-inch extension on each side beyond the standard invert; and for all questionable foundations, inverts varying from 8¼ to 14½ inches thick, reinforced with ⅝-inch bars from 4 to 5¾ inches, according to the size of the section. After the tests above referred to and others also along different lines had been completed, a more conservative program was adopted, as follows:

TYPES ADOPTED FOR CONSTRUCTION AFTER 1916

Three types of invert were designed, to cover the range of variability in foundations. Type A was for compressible soils; type E for poorer than best but better than worst foundations, and type O for solid foundations.

The invert adopted for solid foundations was the original design used throughout 1916.

For the poorer than best foundations, the standard invert of 1915, extended 8 inches on each side, was used.

For the compressible foundations, the inverts were the standard inverts of 1915 thickened from 6 inches to from 7½ inches to 12¼ inches, and reinforced with ⅝ inch bars from 7½ to 9 inches to c., according to the size of the section. This policy resulted in a considerable saving over the extravagant policy of 1916.

While the use of these expensive inverts stopped the occurrence of longitudinal cracks in the inverts, which seemed to be the only ones that excited comment and criticism frim without, they did not in the least stop the formation of transverse cracks in the arches; in fact, these transverse cracks could not be stopped by any means except to put the aqueduct on a pile foundation throughout the country with compressible soil.

The aggregate length of transverse cracks in the aqueduct arches, some caused by temperature because of delaying the backfilling till too late in the season, but most of them by the plan used by the contractors for backfilling, probably exceeds the lengths of the longitudinal cracks by a very large percentage.

The writer attached little importance, so far as the integrity of the work was concerned, to either the longitudinal or transverse cracks, as the cost of preventing these would far exceed the cost of repairs; and the repaired work, being under no strain, would remain in equilibrium in the future.

PRECAUTIONS TO PREVENT FLOTATION OF AQUEDUCT

As to invert designs, but one more condition required consideration and that was for use where the available backfill material was of light weight, the aqueduct submerged and the foundation soil porous for more than a certain depth below grade, varying from 25 inches for the 8 foot 9 inches x 7 foot 4⅝ inches section to 31 inches for the 10 foot 9 inches x 9 foot section.

The problem here was to secure stability and permanence for the aqueduct, full and empty, when the ground water level was above the arch of the aqueduct and the backfill materials so soft, light and lacking in cohesive properties as to be of practically no value except for frost-proofing.

Many studies were made of plans to secure this result, such as gravel backfill, hauled from the District's pits by train, backfills placed by hand, and thin reinforced inverts covered with two or three feet of packed graded gravel, and having a concrete paving over the gravel to form a smooth durable invert.

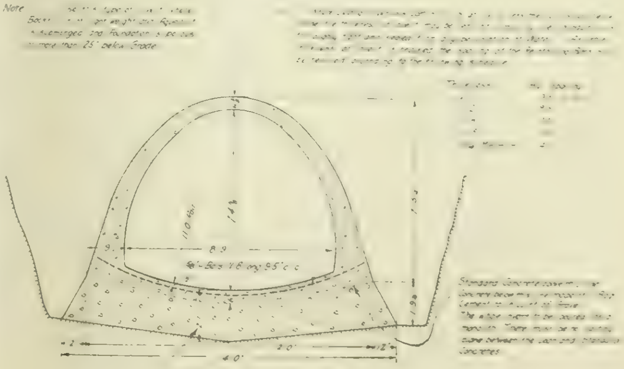
ALKALAI SOIL

As has been already mentioned, the nature of the processes resulting in the formation of the prairie sections, from Winnipeg eastward to the gravel deposits from the glacial drift about Mile 25 has left the soil impregnated with the salts formed from the evaporation of the sea, which once covered this area.

The country is so flat that these have never been washed out of the soil, except locally; rather, there has been a tendency towards concentration, and combination with the soil elements to form compounds which, in the presence of moisture, will combine with the lime in the concrete to form sulphur and chlorine compounds of lime. The sulphur compounds, particularly, are objectionable, because they soften the concrete, if porous at all, and gradually eat into it.

The presence of these salts was found by analyses of many samples in soils at various parts of the line, but not of sufficient concentration to indicate a troublesome action anywhere except certain places west of about mile 30.

(To Be Continued)



SPECIAL INSERT FOR SECTION B TO RESIST FLOTATION

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

Expediting the Hardening of Concrete

New York, September 7, 1920.

Editor, Public Works

Sir:

Please advise me how to expedite the hardening of large concrete block cast before being placed in the structure. I am making about 5,000 blocks in an open-air yard at the rate of about 70 per day. They are cast in iron and steel moulds containing three blocks which I wish to strip and handle as quickly as possible.

I have heard of some method of expediting the hardening of road concrete so that it will sustain traffic much sooner than under ordinary circumstances, and would like to know if it or some other practicable method is applicable to my purposes.

THE ANSWER

The rapidity of the initial hardening depends considerably on the character of the cement used, and is greater with a quick-setting than with a slow-setting cement. If it fills the specifications, a quick-setting cement may be selected that will make a difference in the time required before stripping the blocks. If the cement is already purchased or if greater acceleration is required, it may be obtained without impairing the ultimate strength of the concrete.

For a long time various manufacturers of concrete building blocks, tiles, concrete pipe and the like have used to advantage the steam curing process for their product. This generally consists of some simple form of exposure of the freshly mixed concrete to steam at low pressure or at no pressure, as in the introduction of steam through a jet or through perforated pipe into a closed chamber virtually corresponding to a drying kiln in which the concrete remains for several hours subjected to an atmosphere with temperature and humidity considerably in excess of the normal.

If it is not convenient to place the moulds in a kiln, or to transfer the blocks there after being stripped, some benefit would probably be attained by covering them well with tarpaulins under which live steam is injected. A recent modification of the steam process consists in spraying water over hot pipes so as to heat and atomize it thus producing an atmosphere that is said to be more desirable than the ordinary steam mixture.

An experienced engineer associated with a first-class construction company that has built many millions of dollars worth of concrete buildings in New York and vicinity, in replying to this question states that his firm has made extensive and satisfactory use of calcium chloride, put on the market by the Quickstone Company of Philadelphia, a comparatively inexpensive liquid which requires simply to be added in the proper proportions to the concrete mixing water. Its efficiency is such that it enables the concrete to develop in seven days the strength that the same concrete without the dosage would normally attain in 30 days. It does not injure the concrete and it does not either increase or reduce its ultimate strength.

A series of tests made by a government bureau are said to have indicated that the calcium chloride produces a destructive effect on wire mesh reinforcement embedded in the concrete. Other experiments on concrete with ordinary reinforcement rods embedded in it have failed to disclose such results, but in view of the possibility of producing a chemical action somewhat analogous to rust on the iron or steel, it is recommended that serious consideration be given to the use of this substance before it is adopted for reinforced concrete. For concrete not having reinforcement, no such question prevails and it is considered a very efficacious and satisfactory method of developing the strength of concrete much more rapidly than by the natural hardening.

About 10 miles of reinforced concrete pipe 5½ feet in diameter inside and 8 inches thick were manufactured at the Transcona plant for the Winnipeg Aqueduct Construction Company by the Canada Lock Joint Pipe Company. The steel inner and outer moulds for forms were set on cast iron bases through the center of which a vertical steam jet pipe passed. After being concreted, forms were covered with canvas packets laced together on the vertical joints and with canvas hoods tied to them and supported on spiders.

The pipes were kept filled with wet steam until the concrete had set, after which the hoods and jackets were removed together, the pipe stripped, the hoods and packets replaced and lashed to the iron bases and steam again admitted and maintained three or four days. Details of the pipe construction and curing will be published in a subsequent article.

Winter Road Work in the Northwest

Hauling and distributing gravel and other materials done more cheaply and larger loads hauled over routes that are soft in summer.

For ordinary work, if a contractor or other owner of equipment can figure on two hundred days a year of actual service he is generally fortunate. This means that the interest and depreciation costs of his equipment must be distributed over only two hundred days instead of the three hundred or more which would be possible if inclement weather did not interfere. If by any means he can use the equipment for the additional one hundred days, he can decrease by 50 per cent the charges for interest and depreciation which he must make in estimating past costs or future bids.

To a certain extent or for certain kinds of equipment it may be possible to do this by continuing the work throughout the winter. But certain classes of work, such as laying concrete pavements or the use of asphalt, it is hardly practicable to continue during freezing weather. On the other hand, a great deal of work which involves little more than hauling can be done in winter.

Considerable roadwork of this kind has been done for several years in the Dakotas, Minnesota and Wisconsin. In winter it has been found that some gravel beds are more accessible; that a larger number of teams are available; that, when the ground is frozen, it is possible to haul across swamps and streams as well as over sandy soils and wet wood roads, which it would be almost impossible to haul over in summer with teams and wagons. It also is found that a much greater yardage per team can be hauled. It is reported that in northern Wisconsin from three to six cubic yards of gravel can be hauled by one team and from five to eight yards where four horses are used, the gravel being deposited directly upon the road where it is to lie. Other material, such as stone or gravel and sand to be used for concrete or bituminous macadam, can be hauled in winter and deposited in piles along the side of the road, ready for use in the early spring, when the coming of the frost out of the ground would make the hauling of these materials especially difficult.

Another advantage over winter hauling is that, when the subgrade has been shaped and frozen solid, heavy trucks can carry gravel or other surface material over the subgrade without any damage to it, whereas if such hauling were done in the summer time the subgrade would be badly cut up.

The following suggestions for gravel hauling in winter are given by E. G. Edwards, highway engineer of the Bureau of Public Roads. He says that the pits should be stripped and the approaches graded before the ground freezes. Hauling should begin if possible as soon as the ground freezes, using wagons until there is enough snow for sleds. After once starting, hauling should be continuous so as to maintain a solid road bed, for where the snow is packed hard after each fall the track holds up better during the periods of thaw.

For a seven-yard load of gravel, weighing something over ten tons, a runner 3 inches wide with a bearing length of 6 feet (or about 8 feet including the rise) is required. Using smaller runners on a well maintained snow road is a mistake, as the hauling capacity if the teams is materially reduced. Logging sleds that have been cut down from a 6-foot 8-inch to a 4-foot 6-inch gauge are commonly used but Mr. Edwards thinks that this is a mistake, for he has observed teams hauling fifteen-ton loads on sleds of 6-foot 8-inch gauge with less effort than was required to haul eight or nine tons on similar sleds with the narrow gauge. The explanation he gives is that, where the wide gauge is used, the track for the runners is never cut up by the horses' feet, but there is a smooth, clean bearing the full length of the runner.

In some cases the track is iced, for which purpose a tank mounted on a sled is used. A properly regulated stream of water is allowed to run from the rear of the tank into each of the tracks as the team hauls it along the road.

Boxes for hauling gravel vary from 4½ to 7 feet in width and from 2 to 4 feet in depth and are usually 12 feet long. The bottoms are formed of loose planks usually 3 inches thick and from 3 inches to 8 inches wide, the narrower ones making dumping easier.

Where the road has been graded the previous season for receiving the gravel, the snow is cleaned away by the use of a blade grader and hand shovelling for a width about 4 feet less than the required width of surface. The full amount of gravel is then deposited and, after the frost is out in the spring, the gravel is spread out the full width and shaped to the proper cross section. If the gravel is hauled before the grading is done it is deposited in stock piles, usually eight or ten to the mile, care being taken to place these piles where they will be easy of access and not interfere with the construction work. Rehandling the gravel from the piles to the road costs about 35 cents a cubic yard.

When the gravel has been spread at once, on the going out of the frost the frozen road underneath the gravel thaws out more slowly and drains out through the shoulders. This leaves the road in good condition for shaping up with a road machine. In case of warm rains coming before the road thaws out, however, the frost may be drawn from the subgrade under the gravel before the shoulders thaw out in which case more time and labor are required to get the road into shape.

Loading the sleighs is performed by hand, or by scrapers with a trap, or elevators with bins, as in summer. The cost of loading runs from 35 cents to 45 cents a cubic yard. Spreading costs 10 cents to 20 cents. The average cost for hauling where the length of hauling is from four to seven miles runs from 20 cents to 30 cents per mile per cubic yard. These prices are based on $4 a day for labor and $7.50 to $10 a day for man and team.

In Goodhue county, Minnesota, two wagons pulled by a 6-horse team handled by one teamster hauled in winter at a cost of 95 cents per yard for loading and hauling the first mile and 50 cents for each additional mile. During the summer it was impossible to haul more than one-third as heavy loads, owing to the sandy roads. In another case gravel was hauled by 5-yard trucks over roads which it would have been impossible to use heavy trucks over in the summer months. In Marshall county, Minnesota, on a swampy section of road, the swamp was used to build up the grade about 3 feet above the swamp, the use of a disk harrow and a 10 ton roller compacting the peat into a fairly sound roadbed. This enabled some hauling by wagons before the snow came, but as soon as there was enough snow to use sleds the load per team was more than doubled.

Dry Highway Subgrades

Discussion of the spring break-up of roads by the vice-president of the National Paving Brick Manufacturers Association, and by the editor.

The accompanying letter from Mr. Blair calls attention to a matter which is receiving more thought each year from highway engineers but which is by no means solved. Readers of the highway articles in Public Works during the past year or two will recall several articles dealing with this subject One engineer, for instance, expressed the opinion that in the future it will not be a case of standard 6-inch foundation with a variety of kinds and thicknesses of surface, but rather two or three standard surfaces with a wide variety of foundations, since the natural conditions to be met by the foundation are much more numerous than the traffic conditions to be sustained by the wearing surface.

Mr. Blair states that the most pertinent question is, "Can we build a road that needs no drainage?" We do not understand that he means by this a road of such character that wet soil conditions are not injurious to it, but rather one in which the soil never is allowed to become wet—that is, water is prevented from entering the soil rather than withdrawn after entering. Drains may be used for the purpose of preventing water reaching the roads, or at least for withdrawing the water from a greater or less depth below the surface as fast as it reaches that point, and we do not suppose that the use of drains will be abandoned, no matter what other improvements may be devised.

Mr. Blair does not give any information as to just what he has in mind, but a number of plans would probably suggest themselves to engineers. One of these would be the driving of a line of close sheet-piling along each side of the road, which could be made to keep from the roadway any water originating outside thereof. There are some conditions to which this could not be applied, as for instance in rock cuts. The writer is familiar with two or three such cuts where, in the excavation, pockets were formed in the rock which collect and hold water and at these points soft spots develop each spring or after any rainy season. In some cases what are practically springs are formed in such locations by water which flows on top of the rock under the road and is forced to the surface at points where a bench of rock comes to within a few inches of the surface of the roadway.

There can be no question of the importance of this subject referred to by Mr. Blair, that of preventing the softening of sub-soils by rain. If this can be prevented, we will seldom see such conditions as those illustrated in the New York highways described in our issue of August 14, nor will it be necessary to construct such heavy foundations of concrete or other material to carry the continually increasing loads of truck traffic.

Mr. Blair's letter is as follows:

August 19, 1920.

Editor, Public Works,
New York City.

My Dear Sir:

Both the picture and the characteristic caption, namely, "Making Heavy Repairs on New York Highways after the Spring Break-Up," which is given place on the cover of the August 7th issue of Public Works is so suggestive of common conditions to be found and the question as to why the break-up becomes particularly impressive when we are confronted with so much of that sort of news, both in the technical and in the news press, that it sets my mind working inquiringly.

Have we given the causes of break-ups the study and consideration that is really due? If any consideration at all is given to the matter, does it point in the right direction? For the most part, attention is directed to the load. We see that evidence in all sorts of suggestions and in all sorts of legislation, presumably to prevent or at least to minimize the injury which you characterize as "the Spring break-up." Why the Spring break-up? The loads borne over the roads are certainly no heavier in the Spring than they are in the dryest season of the year. But roads do not break up during the dry season.

Out of the many hundred replies to questionnaires recently sent out by the Federal Highway Council's Committee on "Subgrade and Its Relation to Road Surfacing and Traffic," more than fifty percent located the trouble in the subgrade. These replies came for the most part from engineers and where not from engineers, from persons who have given more than a layman's study to road construction. But in all the lot, not one suggested a remedy. Many expressed their entire inability to suggest a remedy. Others did venture to say that drainage was neglected, thereby giving the inference that drainage might be helpful to the situation.

Certainly one certain conclusion may be drawn from all the information received and that is that if Spring break-ups are eliminated we must discover some practical way of eliminating the influence that superinduce the injurious effects.

A very practical and a very prominent engineer said to the writer but a few days since: "If we can maintain the subgrade of our roads in a dry condition then all else of the problems of road building would become but easy and simple matters" If this be true, however difficult may be the answer, the question itself is a simple one. "How are we to maintain our subgrades in a dry condition?" The question may not indicate a perfect solution. It may be that in certain soils and combination of soils or subgrade condition, containing a large porportion of gravel, a certain amount of moisture will increase its stability and bearing power. However that may be, is there not enough promise in the condition of a dry sub-base to influence the exercise of sufficient thought and ingenuity, to make such a condition maintainable throughout the entire year? Shall it be accomplished in the design, in the grading, some method of obstructing the capillary forces to keep the moisture out, to keep the water away from under the road, or how shall it be accomplished? Please do not somebody say "drain the road," because that presupposes that the road needs to be drained. Can we build a road that needs no drainage? That seems to be the more pertinent question. We do certainly want to get away from the idea of permitting the water to go in the road merely to take it out again. So long as that practice is maintained, the water will surely be under the road in the Spring of the year and the Spring break-ups will occur with certain regularity. True, a flood, a tornado or some other natural and extraordinary disaster will perhaps influence injury to any road construction we might devise. But that would be exceptional.

But certainly we may reasonably expect that a stabilization of our sub-grades can be reliably attained and maintained, and when that much is accomplished we shall have cut down the maintenance and repair charges for our streets and highways to a negligible sum.

Yours very truly,
WILL P. BLAIR.
Vice President, Nat'l Paving Brick
M'fr's Ass'n.

Concrete and Bituminous Pavements in New York State

At six lettings by the New York State Highway Department this year only 47 per cent of the mileage of cement concrete pavements offered was bid upon, 72 per cent of the bituminous macadam mileage, and 77 per cent of the water-bound macadam. There were 90 cement concrete projects, of which 48 received bids; 22 bituminous macadam ones, of which 15 received bids; while bids were received for 3 out of 4 water-bound macadam projects.

Averaging the engineer's estimates of all of the projects and the figures of the lowest bidder for each one bid upon, we find the average engineers' estimate per mile for concrete was $34,849 and for bituminous macadam was $24,222, while the averages of the low bids received were $33,961 and $20,876 respectively. In this connection it is interesting to note that on December 31, 1919, the commission published a report in which it was estimated that pavements for light traffic would cost per mile $24,364 if cement concrete and $22,156 if bituminous macadam, while heavy pavements would cost $28,544 if of cement concrete and $28,600 if of bituminous macadam. It is seen from this that the bids received for concrete roads are considerably greater than the commission's estimate, while those for bituminous macadam are materially less than such estimate.

In the January 30 letting the engineers estimated an average of $32,929 for concrete pavements and the low bids $37,969. In the March letting the engineers increased their estimate for concrete to $35,556, while the low bids dropped to an average of $31,596. In the April letting the average of the engineers estimates and of the bids were $39,205 and $41,430 respectively. At the later lettings the average of the engineer's estimates ran very close to and slightly larger than the average of the low bids received. The estimate of $39,205 and corresponding bid of $41,430 were for construction contracts, while the others were for repair and completion. Of the construction contracts, only 39 per cent of the concrete mileage was bid upon and 18 per cent of the bituminous macadam. Of two completion contracts, 26 per cent of the cement concrete in one case and 62 per cent in the other case were bid upon, while of the bituminous macadam the mileage was 80 per cent and 100 per cent of the total mileage submitted. Of the repair contracts, the mileage of cement concrete bid upon was 65%, 67%, 72% and 52% respectively, while for repairing of bituminous macadam the amount bid was 100% in three cases and 58% in the fourth.

These figures seem to indicate that, combining the bids for construction and repair, concrete work is costing the state $13,000 per mile more than bituminous macadam. The concrete averages 5½ inches thick in some cases and 6½ in others, averaging the center and side thicknesses. The bituminous macadam is understood to be 13 inches thick.

Atlantic City Has New Paving Plant

The city commissioners of Atlantic City, N. J., on August 27 inspected a new paving plant which had been completed a short time previous and it was formally accepted by Street Director Steinbricker. The plant was purchased from the F. D. Cummer & Sons Company of Cleveland. The plant has a guaranteed capacity of 750 square yards of asphalt a day. It was purchased by the city at a cost of $14,900 to be used in the repair and upkeep of the streets. It has been leased to the Cunningham & Murray Paving Company, to be used by it in improving a number of the city streets under a contract which it has with the city. Joseph McCormack, general manager of the paving company, said that he felt confident that he could turn out at least 900 square yards a day with the plant.

Filtration Plant for Covington

The Board of Health of Covington, Ky., on August 25 recommended that the city construct a filtration plant, and that at the fall election the citizens vote upon a bond issue to raise the money for this purpose.

Immigration Notes

Thirty-four Million Arrivals Since 1820

Aliens have constituted 35 per cent of the increase of population in the last century. Rate of arrival now rapidly increasing.

During the last 100 years the population of the United States has increased 97,000,000 of which 34,000,000, equal to 35 per cent have been immigrants. In the decade ending 1910 immigrant's constituted 50 per cent of the total increase. Notwithstanding the influence of the great war, they constituted 40 per cent of the increase during the ten years just ended, while between 1820 and 1830 immigrants were only 1 per cent of the increase in population. It is estimated that the increase in population due to immigration for the ten years ending January 1, 1921 will be about 14,000,000.

Of the 34,000,000 total immigrants during the last 100 years, 8,205,675, nearly one fourth, came from Great Briatain, 5,495,539 came from Germany and 4,100,740 came from Italy, 4,068,448 came from Austria-Hungary, 3,311,406 came from Russia, and 2,134,144 came from Norway, Sweden and Denmark, 523,806 came from France, 256,707 from Switzerland, 214,508 from the Netherlands, 217,256 from Mexico and 834,450 from British North America including Canada. The total numbers of Chinese and Japanese are only 283,398 and 299,030 respectively. Since 1882 Chinese exclusion laws have been in effect.

American Society of Civil Engineers Approves Chinese Immigration

Questionnaire sent to members of American Society of Civil Engineers as to desirability of modifying immigration laws so as to permit importation of Chinese labor, brought about 2,000 answers of which the first thousand have been classified and show 768 in favor of importation of Chinese labor; 101 were definitely opposed, the remainder expressing modified opinions.

In the seven months from January 1st to August 1st, 1920, the total number of alien arrivals in the United States was 250,058, most of them coming from Ireland and Portugal, Italy and Poland. The rate has increased every month excepting February, from 25,051 in January to 56,102 in July. During the same seven months, 185,472 foreign-born people left the United States for their native countries thus leaving a net increase from immigration.

The Italian government is now encouraging emigration of laborers to this country to relieve the present economic troubles there and at present it was stated that 600 are leaving Rome each week and about 2,00 each week from southern Italy. The emigrants from northern Italy usually go to South America, and in all cases there is also a large exodus of families who were held in Italy during the war that are now departing to join their husbands and fathers in this country.

The present value of German marks, French francs, and Italian lira, are respectively about one-tenth, one-third, and one-fourth of their normal value. German labor is now paid about three times as much as before the war when the compensation was about one-half that of corresponding American workmen, so that one who received about $1 in gold in 1913, now receives about 25c per day in gold. The effect of this disparity of wages is bound to be felt in this country when production is under full headway and our imports correspond, making a strong factor to restore conditions here to a more nearly normal plane.

According to L. F. Post, assistant secretary of labor, it is estimated that immigration for 1920 will probably exceed the highest previous yearly amount, namely, 1,250,000 aliens arriving in the United States.

It is reported that the Japanese immigration problem will be solved by an agreement by the United States to permit all Japanese now in this country to become naturalized, and to prevent further immigration.

New York Establishes Pension System

Through an enabling act of the 1920 Legislature a pension system was created, the support of which is to be shared equally between the city and its employees. In the case of the administrative and technical forces, it provides for optional retirement at the age of sixty and mandatory retirement at seventy, with a pension allowance at the rate of one-seventieth of the average salary for the last ten years of service, for each year of service. It is thus made practicable for an employee to retire on a substantial annuity at a period in his life when he can really enjoy it. The contributions to this fund are graded according to class of service, age, and time of entrance into the city service, and range from about four upwards to a little over seven per cent of the employee's salary. In case of withdrawal from the service for any cause, all contributions to this fund on the part of the employees are repaid, together with interest at the rate of four per cent. Incidental features of the plan include pensions for disability, life insurance to the extent of one-half a year's salary, and pension to dependents in case of the employee being killed while in the performance of duty. These latter benefits are paid for wholly by the city, which also assumes the burden of financing the operation of the fund for those now in the service up to October 1, 1921, or such previous date as they may elect to avail themselves of it. Acceptance of the plan is optional on the part of present employees but is mandatory upon those who join the service after October 1, 1920, when the system goes into effect.

Thousands of immigrants, now arrived and arriving at Ellis Island, are unexpectedly subjected to the sudden raise in railroad transportation changes, and some of them have not money to pay the excess for long distances.

Recent Legal Decisions

WAIVER BY SURETY OF TIME LIMITATION FOR SUIT BY CONTRACTOR

In an action by a contractor for highway construction against a subcontractor and the latter's surety, the Michigan Supreme Court held, Hanchett v. Fidelity and Casualty Co., 177 N. W. 993, that the evidence showed that a waiver of the limitation of one year within which the parties had contracted that any suit must be brought on the bond, occurred at a conference between the surety's claim examiner and the plaintiff, though it took place some time before the expiration of the limitation period; and judgment for the plaintiff was affirmed.

AFFIRMANCE OF JUDGMENT AGAINST CONTRACTOR'S SURETY

Two road contractors assigned their respective contracts with the consent of the county to a third contractor, who gave bonds with surety to save them harmless. One hauling gravel for the third contractor got judgment against the two contractors, though keeping no separate account for gravel hauled for each job. One of the two contractors, having an assignment from the other, sued the surety on the bond of the third contractor, his pleading counting on the separate contracts and bonds. The defendant consented to combining the contracts in one suit. The Michigan Supreme Court held, Sullivan v. Fidelity & Casualty Co., 778 N. V. 39, that affirmance of the judgment for the plaintiff on appeal by the surety was not error, though it was not possible to tell how much of the penalty of each bond would be satisfied, the plaintiff filing an acknowledgment that the penalty of each bond would be satisfied to the full amount of the judgment. The granting of a new trial could not help matters.

CONSTRUCTION OF INDEMNITY CONTRACT

Contractors agreed to provide proper, necessary and sufficient safeguards against the happening of any accidents during the repair of the bureau of information at a railway station. An intending passenger, who tripped over a piece of granite left by a sub-contractor, recovered against the railroad company. The Pennsylvania Supreme Court holds, Pennsylvania R. R. Co. v. Roydhouse, 110 Atl. 277, that such recovery will not establish the contractors' liability. It must further appear that they or their agents were guilty of negligence or want of ordinary care. A contract by one working on premises to indemnify the owner is not an "insurance contract," and where the indemnitor has been subjected to increased hazard by reason of the indemnitee using the premises in an unexpected manner, the indemnitor is not liable for ensuing injuries. He is not bound to defend suits against the indemnitee brought without merit even though founded on circumstances in connection with the work.

DECISIONS OF ENGINEER MADE CONCLUSIVE—VERBAL MODIFICATION OF CONSTRUCTION CONTRACT

The West Virginia Supreme Court of Appeals holds, Vaughan Const. Co. v. Virginia Ry Co., 103 S. E. 293, that where a construction contract provides that the chief engineer shall be judge and arbitrator to settle doubts, disputes and differences arising between the parties, his decision and award thereon become final and conclusive on the parties unless successfully impeached for fraud, mistake, or caprice on his part so gross as to amount to fraud on the rights of one or other of the parties to the contract. Where during the execution of such a contract monthly estimates are made by the chief engineer of the work done in accordance with the interpretation put thereon it by him, which are received and acquiesced in without objection, and payments made and received by the contractor, the latter will be estopped on final estimate and award of the chief engineer from putting a different construction on the contract and impeaching such periodical or final estimates except for fraud, mistake or caprice amounting to fraud on his rights.

Where the contractor sets up a modification of the written contract by a verbal agreement between him and the chief engineer, and the written contract provides that no such modification can be made except it be done in writing, the authority of the engineer or the subsequent ratification of the certified contract by the owner must be established by clear and convincing proof; and if the subsequent dealings between the engineer and contractor have all been in conflict with the theory of such modified contract, and the final award and estimate of the engineer have been made in accordance with the written contract the contractor will not be entitled to recover of the owner anything in excess of the prices stipulated in the contract for the different classes of work or material done or provided.

UNREASONABLE DELAY IN NOTIFYING SURETY OF CONTRACTOR'S DEFAULT DISCHARGES SURETY

The Michigan Supreme Court holds, Haberkorn Inv. Co. v. Moran, 178 N. W. 76, following Berkshire Land Co. v. Moran, 177 N. W. 205, when the facts were similar, that where a paving contract called for completion on August 3rd, and the contractor had not even begun the work, unreasonable delay took place when notice was only given to the surety on September 25, saying that the work was to be completed by August 3rd. Under the circumstances, "Such palpable and prejudicial default in a material condition precedent was a substantial breach of the contract which discharged the surety."

NEWS OF THE SOCIETIES

September 20-24 — ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Hotel Pennsylvania, New York.

September 20-24 — INTERNATIONAL ASSOCIATION OF INDUSTRIES. Accident Board of Commissions, Sec., office, Bureau of Labor States; San Francisco ,Cal.

September 21-23—OHIO BUILDING ASSOCIATION LEAGUE, 501 Citizens Bank Bldg., Columbus, Oo.

September 27-30 — ILLUMINATING ENGINEERING SOCIETY. Annual convention Cleveland. H. Wolf, Builders Exchange, Cleveland, chairman Registration Com.

Sept. 27-Oct. 1—NATIONAL SAFETY COUNCIL, 168 North Michigan Avenue, Chicago, Ill.; meeting Auditorium, Milwaukee, Wis.

Sept. 28-29—NATIONAL LUMBER MANUFACTURERS ASSOCIATION. Lumber Standarizing Conference with architects, engineers, contractors and dealers, Congress Hall, Chicago.

October 8 — AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. First fall meeting Philadelphia. Sec., 33 W. 39th St., New York.

Sept. 27-Oct. 21—NATIONAL SAFETY COUNCIL. Ninth annual safety congress at Milwaukee. W. H. Frater, treasurer and business manager, 168 North Michigan avenue, Chicago.

Oct. 12-14—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. St. Louis. Secretary, Charles Carroll Brown, 401 Lincoln Avenue, Valparaiso, Ind.

October 13-15—AMERICAN CIVIC ASSOCIATION. Annual convention, Amherst, Mass. Secretary, E. F. Marshall, Union Trust Bldg., Washington, D. C.

October 16-19—AMERICAN COUNTRY LIFE ASSOCIATION. Annual conference, Springfield, Mass. President, Kenyon, L. Butterfield, Amherst, Mass.

Oct. 1922—INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. 25th annual convention, New Orleans, La. Secretary, C. R. George, Houston, Texas.

November 12—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Second Fall meeting, Chicago. Sec., 33 W. 39th St., New York.

Dec. 7-10—AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual meeting. New York Secretary, 29 W. 39th St., New York City.

Jan. 25-27, 1921—THE AMERICAN WOOD PRESERVERS ASSOCIATION. Place of meeting to be announced later.

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS

Members attending the convention St. Louis, Oct. 12-15 are provided with membership application blanks to encourage the joining of a large number of recruits, who, according to the constitution, may be any engineer, officer or director who shall have charge or supervision over, or any person employed as a consulting engineer on any public, municipal, county, or state department work, or any mayor, councilman or other official of any municipality, county or state. A municipality may be represented by as many active members as it may desire, the representatives of the city holding such memberships being subject to appointment each year by the municipality.

Associate member, any proper person interested in municipal improvement or work as a contractor or contracting agent, or who is a manufacturer of or dealer in municipal supples.

Affilated member, any one interested in the subject of municipal improvements, but not included in either of the above classes of members.

SOUTHERN CALIFORNIA SECTION AM. SOC. C. E.

At a meeting on July 14th at Los Angeles, of the Southern California Section of the American Society of Civil Engineers, a report recommending revision of the ordinance relative to the licensing of architects for plans of concrete buildings was adopted. The report of the committee on terminal investigations was fully discussed and accepted and the directors were instructed to notify the mayor of Los Angeles of the conclusion ot the committee.

AMERICAN INSTITUTE ELECTRICAL ENGINEERS

At their meeting of August 12th, the Board of Directors of the American Institute of Electrical Engineers, accepted the invitation to become a charter member of the Federated American Engineering Societies.

THE ASSOCIATION OF RAILWAY EXECUTIVES

It has been RESOLVED by the association that all of its members and other carriers be urged to devote their utmost energies to the more intensive use of existing equipment; and as definite aims undertake, with the cooperation of the public, to attain:.

1. An average daily minimum movement of freight cars of not less than 30 miles per day;
2. An average loading of 30 tons per car;
3. Reduction of bad-order cars to a maximum of four per cent of total owned;
4. An early and substantial reduction in the number of locomotives now unfit for service.
5. More Effective efforts to bring about the return of cars to the owner roads.

This action is taken by the association BECAUSE it is apparent that under existing conditions transportation facilities, particularly cars and locomotives, are inadequate to handle the unusually large volume of business offered for movement in the country as a whole;

BECAUSE it will be impossible to overcome immediately this deficiency by increasing the number of cars and locomotives (owing to the time required to secure deliveries), and it is clear that conditions require the most intensive use of existing facilities;

BECAUSE it is recognized that upon the release of the carriers from Federal control, not only were cars and locomotives inadequate and in an impaired condition, but the distribution of cars as to ownership was such as to prevent the greatest efficiency in their use, and that since the termination of Federal control constant interruptions due to disturbed labor conditions have seriously interfered with the movement of traffic and the relocation of cars.

NATIONAL CHEMICAL EXPOSITION

The 6th National Exposition of Chemical Industries will be held in Grand Central Palace, New York, Sept. 20-25. The display will be opened at 8 p.m. Sept. 20th by Dr. Chas. H. Herty, chairman of the advisory committee. There will be an address on Cooperation in the Industries by Chas. L. Reese and a motion-picture program showing the U. S. Ammonium Nitrates Plant No. 2 at Mussel Shoals.

More than 400 different exhibits have secured space for this exhibition and arrangements have been made for holding symposiums on Fuel Economy, Industrial Management, Material Handling, Chemical Engineering, and Ceramics.

ILLUMINATING ENGINEERING SOCIETY

The 3rd annual convention of the Illuminating Engineering Society will be held in Cleveland, Oct. 4-7th. The original dates kept for this convention of the American Legion which will be held in Cleveland the last week in September.

ASSOCIATED BUILDING CONTRACTORS OF ILLINOIS

The semi-annual meeting of the Associated Building Contractors of Illinois was held at Springfield, Illinois, Sept. 9-10 with a large attendance, Among the principal papers presented and subjects discussed were, Embargo on Materials, Trade Agreements, Building Conditions, State Legislation, Vocational Training, Shortages and Costs, License for Contractors, Housing Problems, National Legislation, and Organization Work.

ASSOCIATED BUILDERS OF CHICAGO

The Chicago Masons and Builders Association and the Carpenters and Contractors Association have recently united to form the associated builders of Chicago with whom it is expected that the Bupage County Contractors Association will affiliate.

AMERICAN SOCIETY OF SANITARY ENGINEERS

The American Society of Sanitary Engineess with headquarters in the Department of Health, Columbus, Ohio, held a convention on Sept. 7-9th at St. Louis, Mo.

NORTH CAROLINA SOCIETY OF ENGINEERS

The North Carolina Society of Engineers held its annual convention at Ashville, North Carolina, August 12-14 and appointed a committee of five, Chas. E. Waddell, Chairman to draft a law making obligatory the licensing by the state of engineers, and land surveyors. Plans were also made to revise the constitution of the society in order to permit its affiliation with the American Association of Engineers.

AMERICAN ASSOCIATION OF ENGINEERS

At the meeting of the Washington State chapter at Everett, Spokane was selected for the 1921 convention. President G. W. Osgood, Tacoma; first vice president, J. C. Sharp, Spokane; second vice president, F. G. Tetgmeier,, Everett; third vice-president, D. W. McMorris,, Seattle; executive secretary, C. Penny, Seattle,

THE WESTERN STATES RECLAMATION ASSOCIATION

At the August 20-21, conventon at Boise, Idaho of the Western States Reclamation Association a plan was outlined for the irrigation of several million acres of arid western lands and provisions was made for enlisting congressional support of the project.

THE COLORADO SOCIETY OF ENGINEERS

The Sept. 9-10 convention of the Colorado Society of Engineers was held simultaneously with the meetings of the American Institute of Mining Engineers, the American Mining Congress and some other mining societies.

AMERICAN CHEMICAL SOCIETY

The reconstruction meeting of the American Chemical Society was held in Chicago, Sept. 6-9. Among the important papers presented was one on, "The Value of Technical Training in the Reconstruction of Industries," by Thomas E. Wilson and another on "Relation of Educational Institution to the Industries" by Prof. H. P. Talbot. In the department of water, sewage and sanitation, papers were presented by A. S. Behrman, "Water Softening for the Manufacture of Raw Water Ice;" H. E. Jordan, "Specifications for Glass Ware for Water Works Laboratories;" W. D. Collins, "Hardness of Surface Waters in the United States," and Edward Bartow, "The New Sewage Testing Station of the Illinois State Water Survey Division."

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

The first Fall meeting will be held at Philadelphia Oct. 8 and papers will be presented on the Economic Study of Secondary Distribution and on Electrical Demand Measurements at the afternoon session of the meeting, while the evening session will be devoted to the commemoration of the 100th anniversary. the discovery of Arago, Ampere, Davy and Oersted. The November meeting will be held in Chicago, Nov. 12th and the principal paper will be on Lightning Protection.

AMERICAN WELDING SOCIETY

The Chicago section of the American Welding Society was organized at a meeting held Aug 3rd in the rooms of the Western Society of Engineers, Chicago. Many railroads and large local industries were represented by about 75 delegates and arrangements were made for holding meetings on the second Tuesday of each month in the rooms of the Western Society of Engineers. The secretary-treasurer is L. B. MacKenzie, 608 South Dearborn Street, Chicago.

AMERICAN ASSOCIATION OF ELECTRICAL ENGINEERS

The officers elected at the 36th annual convention at White Sulphur Springs, W. Va., were: President, A. J. Berresford; junior past presidents, Comfort A. Adams and Calvert Townley; vice-presidents, Charles S. Ruffner, Charles Robbins, J. T. Robinson, C. E. Magnusson, E. H. Martindale and C. S. McDowell; Treasurer George A: Hamilton; secretary, F. L. Hutchinson. Walter A. Hall, William A. DelMar, Wilfred Sykes, Walter I. Schliter, G. Faccioli, Frank D. Newbury, L. E. Imlay, F. F. Fowle, L. F. Morehouse, Harold B. Smith, James F. Lincoln, E. B. Craft.

PERSONALS

Fellows, W. W. formerly chief engineer of Bangor, Maine waterworks, died Aug. 8th.

Regnier, P. B. engineer of California State Highway Commission died Aug. 9th.

Sjivall, Capt. A. H. has been appointed assistant engineer, New Britain, Ct

Dunlap, Fred C. chief of brueau of highways Philadelphia has also been made chief of street cleaning bureau, Philadelphia.

Bartholomew, Harland, has opened an office in Compton Building St. Louis and will specialize in city planning and similar work.

Riddle, Karl, resident engineer of Federal Aid Road Project work in Dickinson County, Kansas has been appointed chief manager of South Palm Beach, Fla.

Beardsley, J. W. has been appointed a road commissioner for the Panama Government.

Blomquist, H. F. has been appointed water suerintendent Cedar Raids, Ia. to plan and direct extensions and imrovements in the system.

Lafferty & Pfutzenreuter, general contractors have opened an office at 25 E. Jackson Blvd. Chicago.

Fuerst, Robert, has opened a general contracting office in the Place Theater Bldg, Cincinnati.

James, E. H., has been appointed resident engineer of Ballantyne pier, Vancouver. Canada.

Fuller, C. H. R., has been appointed city engineer of Chatham, Ont.

Johnson, A. N. engineer of Portland Cement Association has been appointed dean of the engineering school and director of Engineering Reaserch of the University of Maryland, College Park, Md.

Eaton, A. B., has resigned as city engineer of El Dorado, Kans.

Summers, R. E. J. has been appointed assistant engineer of the H. K. Ferguson Company.

Alger, Major R. W. has been appointed Cleveland manager for the H. K. Ferguson Company.

Lusk, H. B. has been appointed manager of the Southern office of the Great Lakes Lumber Co., Chicago and is located at Hattiesburgh, Mass.

Hinez, H M. has been appointed manager of the Milwaukee office of Henry W. Horst Co., general contractors and engineers.

Krause, Mark C. has opened an engineering office in the Susquehanna Trust Bldg. Williamsport, Pa.

Springman, Wm. E., has opened an office at 844 Rural Ave., Williamsport, Pa.

Haunts Brothers have opened an office at 115 Hepburn Street, Milton, Pa

Belch, James has opened a general contracting office at Gary, Ind.

Luehrs, D. M. has opened a chemical and electrical laboratory at 2015 E. 65 Street, Cleveland.

Darrow,——, has been put in charge of the new office of the H. K. Ferguson Company, industrial engineers, Cleveland.

Thompson & Ginger, Inc. have opened an engineering and contracting office at 150 E. 41st. street, New York City.

Kirkland, H. B. has resumed his duties in charge of the business of the Concrete Mixing & Placing Company Chicago.

Holl, G. A., and Nathan C. Johnston have formed the engineering firm of Holl and Johnston with offices in New York, Milwaukee and Cleveland.

ENGINEERING BUSINESS EXCHANGE

Charles Whiting Baker, for many years editor-in-chief of Engineering News and since 1917 consulting editor of Engineering New-Record, announces his resignation and the establishment under his direction of The Engineering Business Exchange, 30 Church Street. New York City.

The organization is intended to bring together those desiring to sell any sound Engineering or Technical Business—Manufacturing, construction Selling, or Professional—and those seeking opportunities to purchase.

The exchange is prepared to make expert appraisal of plants, and businesses with special determination of future earning power and to prepare and place advertisements without charge.

Registration of purchasers is invited and involves no obligation, the purchaser's interests will be safeguarded and expert efforts will be made to secure business suitable to the individual and worth buying at the price demanded.

WALTER E. MILLER

Walter E. Miller announces his resignation from the staff of the Railroad Commission of Wisconsin, to engage in private practice as consulting engineer, specializing in investigations and studies of steam and electric railway and public utility problems, especially the valuation of such properties, ratemaking therefor reports on efficiency of operation, designing, estimating and supervising construction of new properties and improvements of existing plants. Temporary, office, Pioneer Block, Madison, Wisconsin.

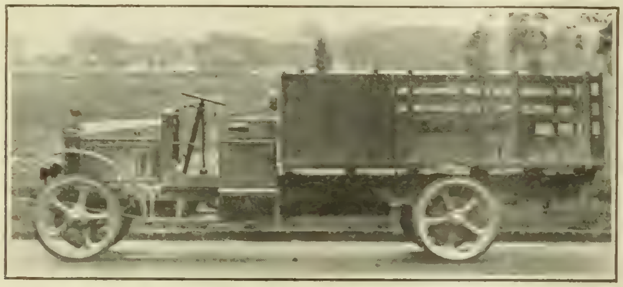
New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

PIERCE-ARROW DUAL VALVE TRUCKS

The Pierce-Arrow Motor Company anounces a new line including 2, 3 1-2, and 5-ton trucks with a tractor unit each equipped with double ignition and electric light. Very strong frames are made for the efficiency of the dual-valve engines with which the trucks are equipped and which are claimed to have a pulling power superior to any demand giving an increase in economy and a greater mileage for gasoline used.

Low repair and maintenance costs are secured by the accessibility that permits quick repairs involving a minimum amount of work and lost time. The trucks have been designed from a practical basis founded on a very large amount of experiences and service and being made with unusual factory facilities, have insured accurate machining and great uniformity of products verified by improved methods of testing.



PIERCE-ARROW DUAL VALVE MOTOR TRUCK

BLAW-KNOX COMPANY'S EMPLOYEES INSURED

As an evidence of the Blaw-Knox Company's appreciation of the value of loyalty, cooperation and continued service it has announced a plan of free life insurance just put into effect. All employees with not less than three months service are insured for $500 those with the Company from six months to one year, $750; from one to two years, $1,000; thereafter with each additional year's service the insurance is increased by $250, until a maximum of $2000 is reached.

The insurance remains in force as long as the employee continues with the Company, although he may continue it at his own expense should he for any reason leave the concern. It is without expense of any kind to the individual covered, the entire cost being borne by the Blaw-Knox Company and this in addition to whatever other benefits may be provided by the State Workmen's Compensation Act. No medical examination is required. The employee names his beneficiary in the same manner as he would under an ordinary policy, and has the privilege of changing this person from time to time as circumstances may demand.

The plan provides benefits in case of not only death, but also total permanent disability. In the event that an employee becomes totally and permanently disabled before reaching the age of sixty he will receive the full amount of his insurance certificate in either annual or monthly installments, according to any one of several plans which he may choose. If death should occur during this period, the remaining installments will be paid to his beneficiary.

CONTRACTORS JACKS

A new automatic lowering jack of 11 tons capacity, made by the Duff Manufacturing Company, is particularly adapted for rapid, heavy duty and is recommended for bridge and car work. Simplicity, strength and durability are the important features, and the large number of small teeth in the lifting rack decreases the rise per stroke and reduces the power required on the lever so much that the strokes can be made much more rapidly.

The simple operating mechanism is contained in a strong closed chamber where, instead of an eccentric, is a more convenient locking lever which is used for shifting the positions of the reversing lever that controls two pawls. There are no small or intricate parts to become lost or broken, and the mechanism can, if desired, be replaced as a unit.

The lifting rack is of forged steel of very sturdy construction. Its teeth each carry only one-half the load which is distributed between them by double-pointed pawls. Heavy fulcrum trunnions cast integral with the socket lever eliminate the fulcrum pin holes that would weaken the socket lever at a point subject to heavy strains. The one-piece socket lever fulcrum has grease packed bushings that afford perfect lubrication and protect the trunnions against wear. The jack is single acting, raising only on the down stroke of the operating handle. It is 22 inches high, has a rise of 11 inches and weighs 87 pounds.

T. L. SMITH COMPANY'S WESTERN OFFICE

A western coast office and warehouse have been opened by The T. L. Smith Co., through its agents, Norman B. Livermore & Co., at 1306 Merchants National Bank Bldg., San Francisco.

A complete stock of Smith equipment and repair parts will be carried at these warehouses continually, subject to shipping instructions from any Smith Agency located in western territory.

STANDARDIZING LUMBER SIZES

The need of standard sizes for all the different lumber products has been felt for some time, due to the exceedingly numerous and constantly changing sizes, and the action of prominent lumbermen in promoting standardization presages another progressive step in the lumber industry. The United States Forest Products Industrial Research Laboratory at Madison, Wisconsin has been cooperating during the past year with the National Lumber Manufacturer's Association in working out an equitable basis for standardizing softwood lumber sizes. The advantages of standardization include:

The possibility of a common language for all.

Architects and purchasers can order more rapidly with one set of sizes.

Material of standard sizes is more salable.

Building design is simplified.

Uniformity in construction results, It equalizes competition between manufacturers. It makes possible uniform practice and sizes in resawing. It makes possible a fewer number of drying schedules in the kiln drying of lumber.

The National Lumber Manufacturer's Association has issued a call for all manufacturers, consumers, and others interested to meet September 28 and 29 at the Congress Hotel in Chicago, at which time action will be taken on the standardization of sizes for all softwood lumber.

GARBAGE INCINERATORS

The Nye Odorless Crematory Company has recently completed plants at Wilson N. C.; Raleigh, N. C. (incinerator No. 2); White Plains, N. Y.; Greenville, S. C. (incinerator No. 3); Clarksburg, West Va.; and Weirton, West Va. They now have under construction incinerators at Wellsville, Ohio, Huntington, West Va., McKinney, Texas, and Stuttgart, Ark.

PUBLIC WORKS.

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

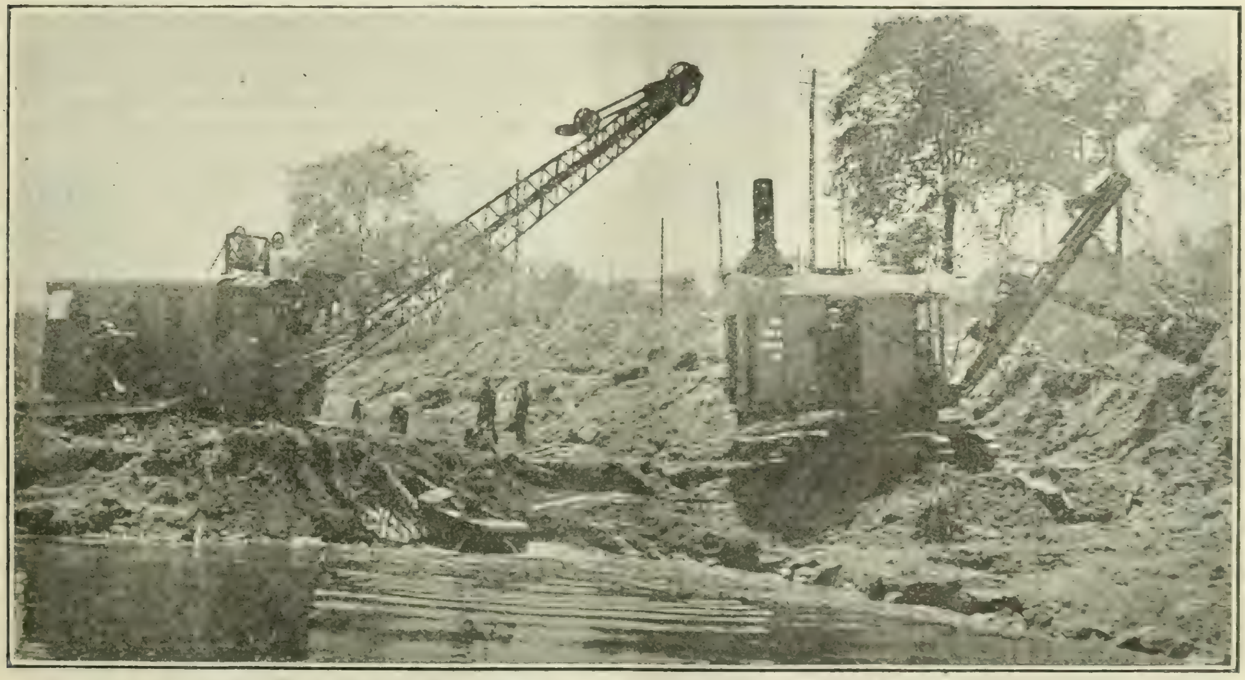
Vol. 49 FLORAL PARK, OCTOBER 2, 1920 No. 14

Earth Moving Machinery in Bronx Parkway

Drag-line excavators, steam shovels, tractors and trailers, dump cars, derrick trucks, mobile derricks, motor trucks, dump wagons, scrapers and other appliances used for excavating and moving several hundred thousand cubic yards of material. Cost records kept and unit costs calculated.

Bronx Parkway is a long, narrow park now under construction between the northern part of New York City and Kensico reservoir in Valhalla, a total length of about 16 miles. The parkway follows the Bronx river, including a narrow strip along each side of the river, the width of the parkway varying from 200 to 1,320 feet. Along a large part of its length it abuts on one side against a railroad embankment and on the other side against a highway. After several years of preparation, actual construction had just gotten well started when the war interfered. Active work was renewed last year, and is now well under way and will probably be continued to completion.

From a money point of view and that of the amount of work involved, earth moving is by far the most important feature of the development of the plans of this parkway, which call for the movement of earth in making excavation and embankment to a total amount of several hundred thousand cubic yards, there being 215,000 cubic yards in the section which is now under active construction. In view of the large amount of earth to be handled and of the labor situation as it was last year and as it still remains to a certain extent in this section, there can be no doubt



SMALL DRAG-LINE EXCAVATING RIVER CHANNEL; STEAM SHOVEL HANDLING SECOND TIME of the wisdom of the Bronx Park Commission in deciding to use machinery to as large an extent as practicable and thus reduce to a minimum the amount of day labor required. The carrying out of this decision was aided by the fact that the commission was able to obtain part of the needed equipment from the army by purchase or in the form of equipment loaned to the State of New York for highway construction purposes.

MACHINERY USED ON THE WORK

The larger pieces of apparatus now being operated by the commission are as follows:

1 Monighan drag-line excavator with 2-yard bucket and 60-foot boom.

1 Monighan drag-line excavator with 1-yard bucket and 40-foot boom.

4 Bucyrus steam shovels, 3 being size 18B and 1 size 14B.

1 Lombard tractor.

2 Holt tractors.

5 Watson bottom-dump trailers of 2 yards capacity.

10 Western bottom-dump trailers of 2 yards capacity.

10 Buffalo-Pitts trailers of 4 yards capacity.

12 Koppel cars, with light construction track.

1 Winther derrick truck.

1 Austin excavator.

2 3-ton Packard trucks.

6 5-ton Hurlburt trucks.

2 1-ton Aviation trucks.

2 Ford runabouts, 2 Ford touring cars and 2 Ford ambulances.

There have been ordered and are now on the way 2 Bucyrus "Universal" shovels, type 30B, and also 2 Bucyrus mobile derricks. Fifteen to twenty teams and wagons are hired at $10 a day for use on the lower section, where is located most of the excavation now under way, and about five additional ones at other points where bridge construction and other small items of work are under way.

The drag-line progresses by a walking attachment, a cam on each end of a shaft through the center of gravity of the machine, and provided with a long shoe which takes bearing upon the ground, permitting the operator to lift the entire appliance, including the turn-table on which it revolves, swing it forward about three feet, and lower it to a new position on the surface.

The tractors and steam shovels are all provided with caterpillar traction. The caterpillar traction was necessary on this work because a very large part of it is in low land along the banks of the Bronx river, and much of it is wet and even swampy.

In addition to the above, there is the necessary amount of small appliances such as drag scrapers, wheelbarrows, shovels and other hand tools, small hand and power pumps, and the like. The commission maintains a machine shop where practically all repairs are performed and some of the simpler appliances are constructed.

All of the work is under the immediate charge of Gilmore D. Clarke, superintendent of construction. The chief engineer is Jay Downer, and L. G. Holleran is deputy chief engineer.

Very soon after he took charge of the work last October, Mr. Clarke revised and extended the method of cost keeping. At the present time the accounts are kept so as to give the cost of the work done by each machine and also the cost per cubic yard of handling earth, including all machinery and labor employed. An illustration of these records will be given further on in this article.

NATURE OF THE WORK

The Bronx river wound with a very circuitous course through a valley bottom that was in general very flat and a few hundred feet wide, with a railroad bank along one side and a highway along the other. The greater part of the low banks were more or less swampy and covered with grass, weeds, cat-tails, etc.

The plans made for the parkway called for the straightening of many of the bends of the river, the forming of pools or lakes here and there and the shifting of the channel wherever it ran close to the foot of either the railroad or highway embankment, in order to permit the planting along

LARGE DRAGLINE DIGGING NEW CHANNEL AND FILLING OLD these embankments of trees and shrubbery which would serve to screen them and the traffic carried over them from the view of those in the parkway. A driveway 40 feet wide is carried continuously from one end to the other of the parkway, sometimes on one side of the river and sometimes on the other, as the location of the river channel requires. This, of course, necessitates a number of bridges across the river. These are being built of concrete, either arch or slab-and-beam construction, but in each case faced with stone in order to present an appearance more appropriate for the surroundings.

In addition to the moving of the channel of the river and grading of the roadway, the low spots are all being raised, connections between the driveway and several of the highways crossing above the parkway (which lies below the adjacent country on both sides) are being made by filling in, and numerous small structures are being constructed, such as culverts, drains for carrying off the surface water, etc. In order to prevent seepage under the roadway of underground water from the hills, a drain is being built along the edge of the roadway furthest from the river for intercepting the underground flow, this consisting of a line of circular drain pipe 4 inches to 8 inches in diameter laid at the bottom of a trench about 2 feet deep and surrounded and covered to a depth of 6 inches with broken stone, concrete size; this in turn being covered with field stone up to 6 or 8 inches diameter placed by hand and carried up to the top of the subgrade and there covered with sod turned upside down on which is placed the top-soil covering. These drains have outlets into the river at all low points.

STEAM SHOVEL USED FOR BUILDING RETAINING WALL

In the section now under construction it was found that the excavation would supply about 100,000 cubic yards less material than was needed for embankment, and this amount of cinders was contracted for and is being supplied from local factories. This and the paving of the roadway are the only parts of the work which are being done by contract, all the rest being done by the Park Commission under its own superintendents.

The cinders are to be covered with two feet of dirt, and this and all new ground in the park is to be covered with one foot of top soil. (It has been found by experience in New York City that two feet of earth and one foot of top soil on a cinder fill will permit the growth of trees as well as of shrubs and smaller vegetation.)

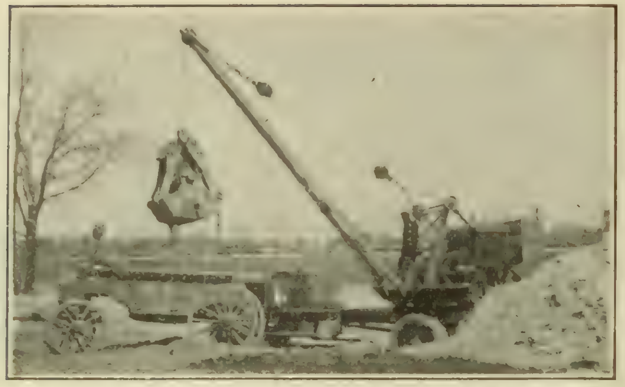
STEAM SHOVEL FILLING HORSE DRAWN WAGON GRADING DOWN HIGH LAND

METHOD OF OPERATION

In moving the river channel it is, of course, necessary to provide a new channel at each point before the old channel is filled in. Also it is necessary to study carefully the most economical method of handling the dirt excavated in the making of the desired fills so as to reduce the haul to a minimum and perform all handling by the appliances most economical for that particular service.

The appliances used for original excavating of the earth are the drag-line and the steam shovel. Transportation of the earth is performed by means of horse-drawn trucks, tractors and trailers, motor trucks, dump cars on portable track and drag scrapers. The drag scrapers are used almost exclusively for leveling off the dirt dumped by trucks. Koppel dump cars were used at first, but a large part of the material excavated is so wet and sticky that it was found that it would not slide out of the cars when dumped; although it would, of course, drop out of a truck with bottom dump and practically vertical sides. Consequently the dump cars are not now being used, although they may be used again if suitable material is encountered. The motor trucks are used very little, if at all, for hauling excavated material, but their duties are rather confined to the hauling of broken stone, drain tile and other materials used on the work.

Most of the hauling of excavated material is being done by dump wagons used as trailers behind tractors with caterpillar traction. Four-yard trailers were used at first in trains of three, but in the soft ground it was found that these sunk in too deep and some were practically pulled to pieces by the tractors when trying to draw them through the wet bottom land. (The river, although a small stream, is subject to frequent and very considerable freshets which cover the bottom land and keep it soft, in addition to making work impossible for a day or two at a time.) Two-yard wagons are now being used as trailers, five to a train. The amount of dirt hauled by these tractors and trailers, of course, depends upon the



DERRICK TRUCK FITTED WITH CRANE AND CLAM-SHELL BUCKET

length of haul, and this varies anywhere from 200 or 300 feet to 1,500. For short hauls, the two tractors and ten trailers will easily handle 500 cubic yards a day. At one place where the length of haul was 1,500 feet, the average amount hauled was about 350 cubic yards. At some points where there is not sufficient width of fill to permit the tractors to turn around, it is necessary to use horse-drawn wagons, which can turn in a much narrower space.

It was found that the original excavating of most of the material could be done much more cheaply with the drag-line than with the steam shovel. In partial explanation, at least, of this, it is to be remembered that the greater part of the excavating is being done below the level of the machine and frequently from the bottom of the river, while the material is being disposed of at a higher level. Because of the greater efficiency of the drag-line for such work, this machine is being used exclusively for the first excavating of such material. Where the excavated material is to be deposited along the banks immediately opposite the point from which it was removed, no more rehandling is necessary except for a general leveling off and grading of the embankment. Where the excavated material is to be moved across the valley more than 75 to 100 feet, a second and sometimes a third movement of the material is effected by the drag-line. It is found that moving three times by the drag-line costs less than excavating by the drag-line, depositing in trailers and carrying by tractor to the desired point. Where the material excavated is to be moved lengthwise of the valley, however, the drag-line cannot effectively complete the handling of the material.

The general method of operating the drag-line is to place it near the bank of the river or the line selected for the bank of the new channel, remove first all the top soil and deposit it in a bank along the edge of the channel; then, when all the top soil that can be reached from this position has been removed and deposited, the soil beneath is removed and deposited back of this embankment. This bottom soil, which is frequently the muck from the bottom of the river, is thus prevented by the embankment of top soil from flowing back to the channel. In all cases the top soil is kept separate from the rest of the excavation and is used later for giving a 12-inch covering to all new embankment.

As soon as all of the material that can be reached by the drag-line from a given position, down to the desired depth, has been removed and deposited at one side of and behind the drag-line, the machine then moves by its walking equipment to a new position a few feet up or down stream and repeats the process.

The larger drag-line with the 2-yard bucket, when timed by the writer, excavated a bucket full for each 40 to 50 seconds, averaging 45 seconds per bucket. It is found that the buckets are nearly always filled to their full capacity, but about 10 per cent is allowed for shrinkage, due to settlement, draining out of water, etc. Both of the drag-lines are worked sixteen hours a day in two shifts, from 6 in the morning till 2 in the afternoon and from 2 until 10. The larger drag-line has a 90 h. p. engine burning kerosene and the smaller drag-line has a 3-cylinder gasoline engine. These drag-lines together average about 900 to 1,000 yards in each 8-hour shift, or 1,800 to 2,000 yards a day. When it was attempted to have the drag-line deposit the excavated material directly into carts or dump cars, the amount of work done was very much reduced because of the delays in waiting for cars, shifting them into position, etc. It is found to be cheaper in the long run, where the material has to be handled by trailers, to use a steam shovel for loading on to the trailers material which has previously been excavated by the drag-line. The steam shovels also are used for excavating the higher land, where the dirt to be removed lies above the contemplated grade.

THREE TRAILERS DRAWN BY HOLT TRACTOR

The drag-lines were assembled and set up by the commission on the site, and the only practicable method of moving them from point to point along the work appears to be by walking them under their own power, although such progress is naturally very slow. The larger machine weighs about eighty tons and, assuming that a truck could be obtained stout enough to carry it, many of the bridges on the line of the roads could not safely carry such a load.

In operating the two drag-lines and the four steam shovels, eight operators are employed. In addition to these, there are altogether 230 employees, half of them day laborers and the other half drivers, chauffeurs, foremen, mechanics, etc. The greater part of the day labor is used in building drains, bridges, culverts and other small structures and in doing the final grading of the embankments. In the main dirt handling, practically the only labor employed comprises the eight drag-line and shovel operators, the two tractor operators, two or three men and horses with drag-scrapers spreading the material dumped by the trailers, and six or eight more as helpers around the various pieces of apparatus.

COST RECORDS

The operator of each of the large machines sends in a weekly report of the operation of his machine, the week extending from Thursday to Wednesday, both inclusive. The weekly report gives the date, section number, machine number, name and type of machine, time of shift, and type of vehicle loaded, if any. The vertical columns have headings as follows: "Hours engaged" ("from"-"to"). "Time used in moving." "Time used for repairs or shut-downs." "Nature of repairs or shut-downs." Under the main heading, "Number of buckets excavated," are the seven sub-headings: "General," "River," "Lake," "Top soil," "Second handling," "Third handling," and "Loading." Under the general heading, "Helper," are the two column headings, "Time" and "Rate."

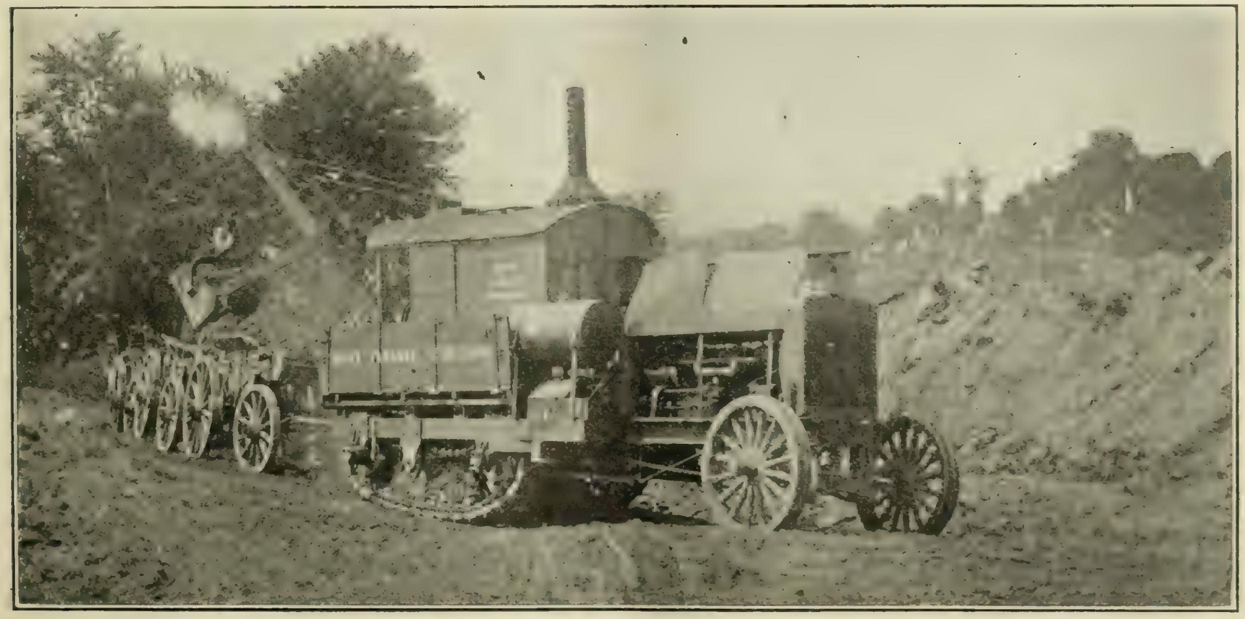
These data are entered on a special sheet devoted to the machine in question. The summaries are also recorded on another sheet giving the amount of work done and unit costs for each of the several pieces of apparatus on the particular section of the work to which this sheet applies. Each machine has a separate record, the headings on which are as follows: "Date," "Operators," Helpers," "Watchmen," "Fuel," "Oil and grease," "Miscellaneous supplies," "Depreciation," "Repairs" ("Labor"-"Material"), "Cost of excavation," "Cubic yards excavated," "Unit cost," and "Remarks." The cost of each of these items is given for each day, and at the bottom of the sheet is given the total for the month. In addition there is given at the bottom the total for the entire period since the machine went into service, and from this is calculated the unit cost averaged for the entire period of service of the machine. These total costs include depreciation, costs of watchmen, and all other costs connected with the machine during winter and other idle periods as well as during the season of operation, so that the unit cost averaged to date provides for all expenditures and overhead charges for the machine up to that time.

ACTUAL COST FIGURES

As an illustration of the costs, the following figures are given from the records:

For the smaller Monighan drag-line, during the month of August the charges were as follows: Operators, $465.79; helpers, $422.25; watchmen, $31; fuel, $361.95; oil and grease, $35.53; miscellaneous supplies, $15.80; depreciation, $184; repairs, $16.88 for labor, $26 for materials. This gives a total cost of $1,559.20. 11,075 cubic yards were excavated, giving a unit cost of fourteen cents per cubic yard. For the same machine, the totals up to the end of August included $2,024 for depreciation, $1,833.90 for labor in making repairs and $1,874.89 for materials. Up to that time the machine had excavated 68,595 cubic yards and the unit cost, averaging the entire period, had been 21.8 cents per cubic yard. In this calculation the depreciation is based on an assumption of a life of four years working 250 days a year, or 1,000 days of work.

The above includes considerable work which was done under unfavorable conditions. Taking only one year, that of 1919, the unit costs figure out as follows: Labor of all kinds, 8.05 cents per



FIVE TRAILERS DRAWN BY LOMBARD TRACTOR

cubic yard; gasoline, 2.86; lubricating oil, 0.50 cents; miscellaneous supplies, 1.71 cents; depreciation, 3.375; giving a total average cost of excavation of 16.5 cents a cubic yard.

The larger Monighan machine began work on May 12 of this year and up to the end of July the totals had been as follows: Operators, $925.68; helpers, $1,233.13; watchmen, $249.50; fuel, $1,324.89; oil and grease, $310.15; miscellaneous supplies, $1,223.83; depreciation, $2,003.18 repairs, $158.39 for labor and $114.12 for material; total cost of excavation, $7,542.87; cubic yards excavated 55,162, giving a unit cost of 13.6 cents per cubic yard.

One of the steam shovels for the month of June gave the following cost: Operator, $200; helpers, $140; watchmen, $60; fuel, $216.66; oil and grease, $45.95; miscellaneous supplies, $3.36; depreciation, $184; repairs, nothing; total cost of excavation, $849.97. 11,477 cubic yards were excavated, of which 1,716 was second handling, 1,590 was third handling, and 4,095 was top soil. This gave an average cost of 7.4 cents per cubic yard, but this average includes no allowance for cost while lying idle during the winter or for repairs. This machine has excavated 20,803 cubic yards to date and the totals are recorded as $1,198.38 for operators; $1,020.75 for helpers; $1,133 for watchmen; $1,814 for fuel; $123.60 for oil and grease; $218.72 for miscellaneous supplies; $1,420.54 for depreciation; $358.75 for labor and $180.36 for materials for repairs; giving a total cost of $7,468.09. From this should be deducted $1,885, the cost during three months when the machine was engaged in building retaining walls. For the five months of excavating and idleness covered, the record gives an average cost of 26.8 cents per cubic yard, showing the considerable difference between an average that allows for all overhead and a figure applying to only one favorable month. It is apparent that these averages of long periods which include the idle winter season are the correct ones for determining the actual cost of the work.

The records for the total cost of handling earth in the section now under construction for the month of July, 1920 (with no allowance for winter maintenance), obtained by dividing the total operating cost of each machine employed by the total amount of earth handled, show that the cost of drag-line excavating that month was 9.1 cents per cubic yard; steam shoveling, 14.7 cents; tractors and teams, 22.6 cents; spreading on the dump, 11.2 cents; giving a total cost per cubic yard handled (a considerable amount of it two and even three times) of 57.4 cents per cubic yard.

The Labor Situation

General development since 1915; present conditions and requirements; definite policies; supply, strikes and wages

A review of the present labor conditions and prospects in the United States is inseparable from consideration of the conditions existing before the entrance of this country into the world war and the unprecedented changes that have taken place in direct and indirect consequence thereof.

Previous to 1914, labor conditions in the construction field, to which this article is strictly limited, were substantially uniform and regular in most parts of the country. Labor was abundant. The standards of hours and wages were fairly well proportioned to intrinsic values, and were generally accepted by employers and employees. Efficiency and reliability were normal and the occasional strikes and lock-outs were of local character and generally subject to reasonable settlements.

There was no general serious surplus or shortage of labor or employment and in most of the large cities notices that extra help was required would bring abundant applications promptly to the job. Where a large construction force had to be quickly secured for remote districts, advertisements, application to foremen and skilled laborers, or commissions to padrones or employment agencies procured men readily at current prices. Contractors could estimate with considerable accuracy the cost and efficiency of labor and could depend on securing it at prevailing rates, or at a slight increase under special conditions, and were, therefore, able to make safe bids for important or long-continued work at reasonable prices, the situation then being a familiar one resulting from the gradual growth and development of years.

EFFECTS OF THE WAR

For many years the increasing tendency of this country has been for native Americans to work principally at skilled labor or in commercial or executive positions, leaving a large amount of common and especially heavy labor and much of the mechanical and trade work to be done by labor of foreign birth or parentage. In other words, the resident supply of common and a considerable proportion of skilled labor was becoming more and more inadequate and greater and greater dependence was placed on immigrants, the rapidly increasing annual supply of which had attained a maximum of 1,218,480 in 1914, which was probably equivalent to 850,000 working men and boys.

At the beginning of the war, immigration was violently arrested by the absorption into their armies and civil occupations, of the total man power of the belligerent countries that had previously been the principal sources of immigration to the United States. In 1915, the total immigration dropped to 326,700 and in 1918 to 110,618, minimums which, when further reduced by the greatly increased number of aliens (most of them working men) who left this country to join the armies of their Fatherlands, entirely eliminated the foreign labor supply and caused a deficiency of more than 1,000,000 men a year below normal.

This quickly altered economic conditions so that men were difficult to obtain in large quantities and wages advanced considerably, impelling many farsighted contractors to give serious attention to developing their organizations and efficiency and to the increased use of labor-saving methods and appliances. It was still possible to secure, at a price, men for construction work, but the work had to be planned with due regard to the impaired quality and amount of labor available.

The increased exports of war materials and other supplies also helped to increase the demand, and with it the wages, for labor, but conditions did not become very serious until after the United States entered the war in April, 1917, and the national resources were applied to the utmost in military directions. Besides 2,000,000 men drafted into the army and navy, an enormous number of men were required to fill the new positions produced by the increased export business and by the tremendous Federal construction operations and war work on ammunition, supplies, etc. These demands absorbed all the ordinary labor supply and extended to great numbers of women, girls, boys and old men not previously engaged in such pursuits, leaving barely enough men to carry on indispensable operations, after a large amount of work, including general and engineering construction and most public works and improvements, had been specfically prohibited as non-essential by the Federal Government.

Labor was accordingly scarce and exceedingly dear. The government policy of executing more than $1,000,000,000 worth of emergency construction with selected contractors operating on cost-plus basis, together with its avowed intention to increase wages to correspond with increased general costs and a frantic disposition to yield to all of labor's demands and satisfy its wishes regardless of consequences, inevitably produced an artificial condition, making labor a favored class. This condition was quickly realized and exploited to a high degree, with the result that wages doubled and trebled and labor made exorbitant demands and became more and more arrogant. Labor hours were shortened, heavy overtime rates were established and great numbers of unskilled employees were rated as skilled employees, seriously reducing the quality and output of work.

These conditions necessarily produced idleness and extravagance; many men worked only part time and their efficiency was greatly decreased, while costs multiplied.

At the close of the war the requirements disappeared with the emergency, but union leaders still insist that there shall be no diminution of employment or reduction of wages, and the result has been unexampled labor unrest and unreliability, the multiplication of strikes and an endless increase of wages that has scarcely yet reached its maximum. Altogether the result has been a general increase of more than 100 per cent in wages, and a decrease of at least 50 per cent in efficiency, making unit costs for construction work, exclusive of materials, often four times or more as great as formerly. This and the plague of unjustified strikes and the violation of contracts by labor organizations has made it impossible for contractors to estimate safely on labor costs and they have been compelled to refuse to bid, or to bid only on a cost-plus basis, for important or long-continued work.

This and high material prices have resulted in postponing a large amount of work, including $2,000,000,000 or $3,000,000,000 worth of deferred construction due to war conditions, all of which is ready for resumption under more favorable and safer conditions.

At present, the supply and demand for labor are fairly well balanced, but in order to regain normal or well-proportioned prices and wages, or to undertake the vast amount of new and accumulated construction, great quantities of additional labor, especially unskilled workmen variously estimated at 1,000,000 to 3,000,000, are urgently needed.

A large part of these men are available by immigration. The number of aliens entering this country has begun to increase very rapidly during the present year and is now limited only by the available transportation. Although some foreign countries will doubtless endeavor to restrict emigration, the supply will doubtless be adequate if this country permits and encourages immigration. The great necessity is for an abundance of unskilled labor, which can be secured not only from Europe, but also from Asia, Mexico, Porto Rico and other countries and should be admitted with proper restrictions.

It may perhaps be advisable to discriminate between permanent immigrants who should become citizens, and temporary immigrants for whom the illiteracy test might be waived. In all cases, political opposition should be removed and efficient provision made for excluding radicals and criminals, and for the thorough Americanization of all who are admitted as permanent immigrants.

There should also be proper legislation to incorporate labor organizations and make them responsible, and to enforce the execution of contracts between employer and employee and prevent violence, intimidation and conspiracy in labor controversies. Given such conditions, there should be no difficulty in securing abundance of labor at a fair price for all kinds of construction work.

WAGES

In October, 1915, the standard rates for skilled and unskilled labor in Greater New York were listed as:

Blacksmith, $3.68 to $4.00; blacksmith helper, $2.00 to $2.25; blaster, $4.50; bricklayer, $6.00; caulker, $4.50; cranesman, $125 per month; dock builder, $4.00; drill runner, $3.68; drill helper, $1.75 to $2.00; electrician, $4.80;

electrician helper, \$2.00 to \$2.50; engineer, compressor plant, \$125 per month; engineer, hoisting, \$4.25; engineer, locomotive, \$125 per month; engineer, shovel, \$150 to \$175 per month; fireman, \$60 to \$80 per month; hoister runner, \$4.25; hoister on steel, \$5.50; iron erector, \$5.00; iron helper, \$3.00; laborer, common, \$1.60 to \$1.75; laborer, concrete, \$1.75 to \$2.25; laborer, handy, \$2.25 to \$3.00; laborer, rigging, \$2.00 to \$2.80; machinists, \$3.00 to \$3.50; mason, stone, \$4,80; painter, iron, \$2.25 to \$2.50; pipemen, \$2.00 to \$2.25; pipe fitter, \$3.00 to \$3.50; pitmen, \$2.50; pumpmen, \$2.00 to \$2.25; rigger, boss, \$4.80; riveter, \$5.00; rockman, \$2.25; shorer, \$3.68; shorer helper, \$2.65; signalmen, \$1.75 to \$2.00; stablemen, \$2.00; stonecutter, \$4.50 to \$5.00; timbermen, \$2.25 to \$3.00; timbermen helper, \$1.75 to \$2.00; waterproofer, \$4.25.

On April 22, 1920, the executive committee of the Board of Governors of the Building Trades Employers' Association, New York, in conference with the representatives of the Building Trades Council, agreed to a schedule of wages allowing an increase of \$1 per day after May 1, 1920. The new scale, based on an eight-hour day, now in effect, is:

Art glass workers, \$8.00; asbestos workers and insulators, \$9.00; bluestone cutters, \$9.00; bricklayers, \$10.00; carpenters, \$9.00; dockbuilders, house shorers and sheathpilers,\$9.00; cement and concrete workers (laborers) \$6.50; composition roofers and waterproofers, \$8.00; composition roofers and waterproofers (foremen), \$8.50; electrical workers, \$9.00; electrical workers' helpers, \$5.50; elevator constructors, \$9.00; elevator constructors' helpers, \$7.00; hoisting engineers, by the week, \$52.25; hoisting engineers, by the day, \$10.00; hoisting engineers, running compressors, extra per week, \$7.00; housesmiths and bridgemen, local No. 40, \$9.00; housesmiths' finishers, Local No. 52, \$9.00; housesmiths' helpers, \$7.00; marble cutters and setters, \$9.00; marble carvers, \$10.00; marble polishers, bed rubbers and sawyers, \$8.50; marble cutters' helpers, riggers, crane and derrick men, \$7.00; mosaic and terrazzo workers, \$8.00; mosaic and terrazzo workers' helpers, \$6.50; metallic lathers, \$9.00; plasterers, \$9.50; plasterers' laborers, \$7.00; plumbers and gasfitters, \$9.00; roofers and sheet metal workers, \$9.00; riggers and machinery movers, \$9.00; steam and hot water fitters, \$9.00; steam and hot water fitters' helpers, \$7.00; stone derrickmen, \$8.00; tile layers, \$9.00; tile layers' helpers, \$7.00; wood lathers, \$9.00.

Common labor not included in the above scale is paid from \$5.20 to \$6.00 per day.

Information concerning conditions in their vicinities was furnished at our request by eleven contractors located in New York, Pennsylvania, Ohio, Iowa, Wisconsin, Oklahoma, Michigan and North Dakota; these contractors making a specialty, respectively, of street paving, highway construction, water works and sewer construction, tunnels, buildings, and general contracting. These reported that since last spring wages in their several localities had increased from a minimum of 10 per cent in one case to a maximum of 85 per cent in another (the latter being in Milwaukee), with an average of 31 per cent. The wages paid common labor were reported as 50 to 65 cents an hour, 55 to 60 cents, 55 cents, 61 cents, 65 cents, 65 to 70 cents, and 90 cents in two cases, \$5 a day in one case, \$5.50 in another and \$6 in a third. Replying to the question whether labor was more plentiful than last spring, six answered yes, four no, and one that it was unchanged. However, nine of the eleven believed that it would be more abundant in 1921, one was in doubt, and one believed that it would not be.

A Clearing House for Labor

Employmeent secured for labor, help secured for employers, and surplus labor shifted in and between 18 zones by a Federal bureau.

In February, 1915, the scope of the activities of the Division of Information of the Bureau of Immigration, United States Department of Labor, was enlarged to cover employment. The United States was divided geographically into 18 zones, some of which were sub-divided, each division or sub-division being in charge of an immigration inspector to receive applications from employers and those in search of employment with a view of filling both wants. In the first six months, up to August, 1916, the division received 94,482 applicants for positions and filled 16,974 positions. During the month of July, 1915, the total number of applications received for help was 1,160, number of persons applied for 8,665, number of applications for employment 18,061, number referred to employment 6,360, number actually employed 6,035. The classification by zones was as follows:

No. 1—Boston, Mass.
No. 2—New York, N. Y., Buffalo (sub-branch), N. Y.
No. 3—Philadelphia, Pa., Pittsburgh (sub-branch), Pa.
No. 4—Baltimore, Md.
No. 5—Norfolk, Va.
No. 6—Jacksonville, Fla.; Charleston (sub-branch), S. C.; Savannah (sub-branch), Ga.; Birmingham (sub-branch), Ala.; Mobile (sub-branch), Ala.
No. 7—New Orleans, La. (sub-branches).
No. 8—Galveston, Tex.; El Paso, Tex.; Albuquerque, N. M.
No. 9—Cleveland, Ohio.
No. 10—Chicago, Ill.; Detroit (sub-branch), Mich.; Indianapolis, Ind.; Sault Ste. Marie, Mich.
No. 11—Minneapolis, Minn.
No. 12—St. Louis, Mo.; Kansas City (sub-branch), Mo.
No. 13—Denver, Col.; Salt Lake City (sub-branch), Utah.
No. 14—Helena, Mont; Moscow (sub-branch), Mont.
No. 15—Seattle, Wash.; Aberdeen, Wash.; Bellingham, Wash.; Colfax, Wash.; Everett, Wash.; North Yakima, Wash.; Spokane, Wash.; Sumner, Wash.; Tacoma (sub-branch), Wash.; Walla Walla (sub-branch), Wash.
No. 16—Portland, Ore.
No. 17—San Francisco, Cal.; Sacramento, Cal.; Fresno, Cal.; Eureka, Cal.
No. 18—Los Angeles, Cal.; San Diego, Cal.; Tucson, Ariz.

After the entry of the United States into the war, the activities of this division were extended

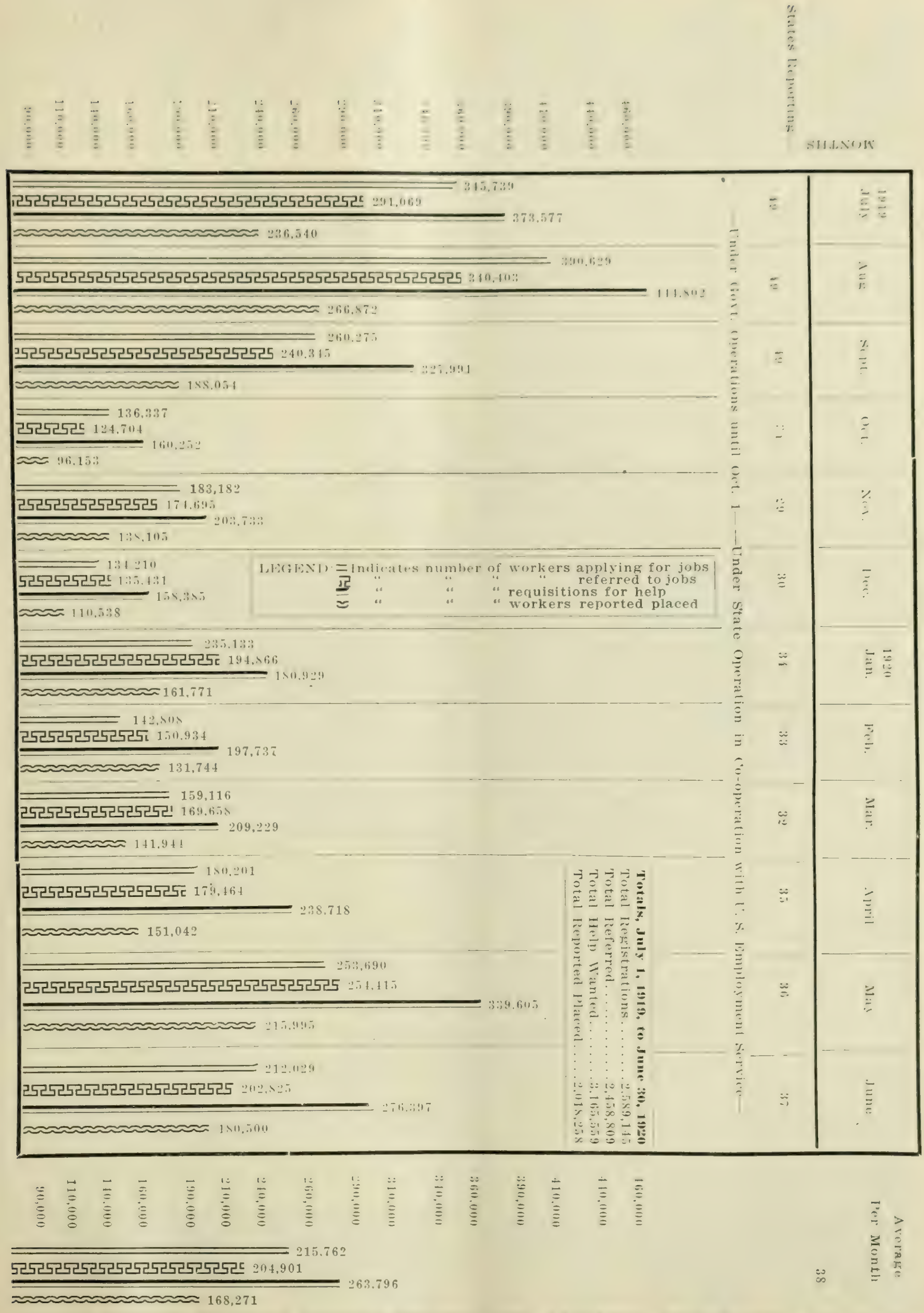


CHART SHOWING RELATIONS BETWEEN REGISTRATIONS, REFERRED, HELP WANTED, AND PLACED, BY MONTHS, FOR THE YEAR JULY 1919—JUNE 1920.

and employment was secured for a very much larger number. In the year ending July, 1920, there were received 2,589,145 registrations, of which 2,458,809 were referred to prospective employment. There were also received 3,165,559 requests for help wanted and there were placed 2,018,258 employees, as shown by the accompanying diagram. The scope of the most recent activities is indicated by the weekly records, that for the week ending July 5, 1919, gives registrations, 74,703; help wanted, 83,843; referred, 65,597; placements, 53,587; for the week ending July 26, 1919, registrations, 95,619; help wanted, 91,222; referred, 75,052; placements, 65,998; week ending January 31, 1920, registrations, 36,243; help wanted, 47,214; referred, 38,306; placements, 30,990; week ending May 29, 1920, registrations, 49,168; help wanted, 65,804 referred, 49,884; placements, 43,247.

It is evident that this system is potential for valuable service to labor and to employers and that it should be utilized and appreciated by both. Great efforts should be made to avoid any partiality for either union or non-union labor, and both organization and individual laborers, and individual and associated employers, should file regular reports with the division, whether or not they are in need of its assistance.

Increased results should also be secured by cooperation with the principal associations, organizations and federations of general contractors, municipalities, manufacturers and all other large employers of labor, including farmers.

Some means of simplifying this service by inspection and classification of labor so as to secure the best men fitted for the work and rate them according to their abilities would be helpful. Further efforts along the lines of transferring men from a crowded trade or area to one in which there is a chronic deficiency would also be desirable to both parties and would tend to equilibrium and standardization. Such discrimination might perhaps be extended even so far as the arbitrary allotment of certain classes of immigrants to appropriate localities, thus relieving the congestion in cities and the labor famine in other places.

Total Activities Week Ended July 17, 1920.

State	Registrations	Help Wanted	Referred	Placements
Alabama	136	105	81	46
Arkansas	32	33	29	22
Colorado	1,315	979	566	540
Connecticut	1,066	1,068	911	864
Dist of Columbia	731	619	495	382
Georgia	92	35	62	22
Illinois	6,573	6,613	5,805	5,166
Indiana	454	589	418	398
Kansas	736	762	631	468
Kentucky	75	16	33	8
Louisiana	105	111	89	88
Massachusetts	564	1,004	1,235	676
Michigan	2,157	1,970	1,710	1,676
Minnesota	2,300	2,940	2,279	1,827
Missouri	1,517	1,444	1,370	1,361
Nebraska	1,107	1,110	1,055	1,031
New York	9,081	8,697	8,258	7,517
North Carolina	46	40	45	44
North Dakota	309	223	279	256
Ohio	8,743	6,324	5,736	4,880
Oklahoma	1,179	1,179	1,095	975
Oregon	1,040	1,031	1,043	979
Pennsylvania	5,789	11,672	5,251	5,006
Rhode Island	130	136	202	118
South Dakota	168	147	93	71
Texas	382	251	262	107
Virginia	125	170	98	84
Washington	1,199	1,074	1,029	937
West Virginia	223	327	217	214
Wisconsin	2,402	3,203	2,397	1,833
Total 30 states	49,756	53,972	42,802	37,596

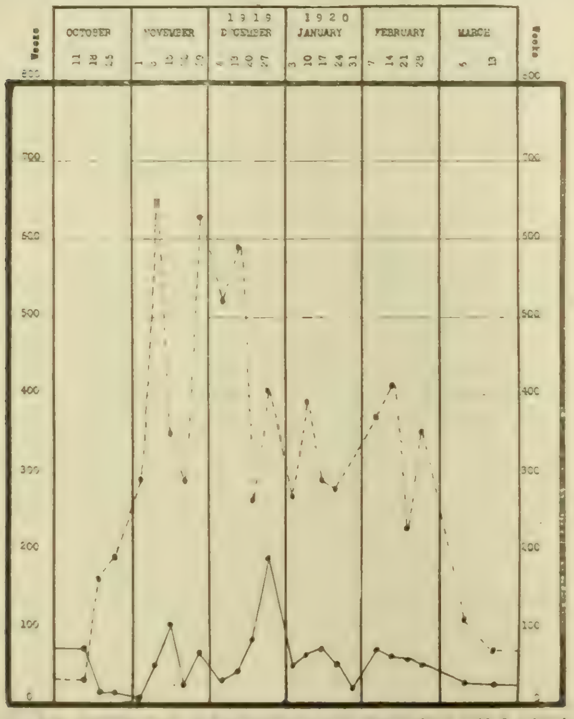


CHART SHOWING REPORTED SHIPMENTS OF LABOR, WEEKLY, BETWEEN STATES FOR PERIOD UNDER STATE FEDERAL OPERATIONS, OCT. 11, 1919 TO MARCH 13, 1920
SKILLED ———— UNSKILLED ....
FIRST COLUMN, NUMBER OF PERSONS TRANSFERRED

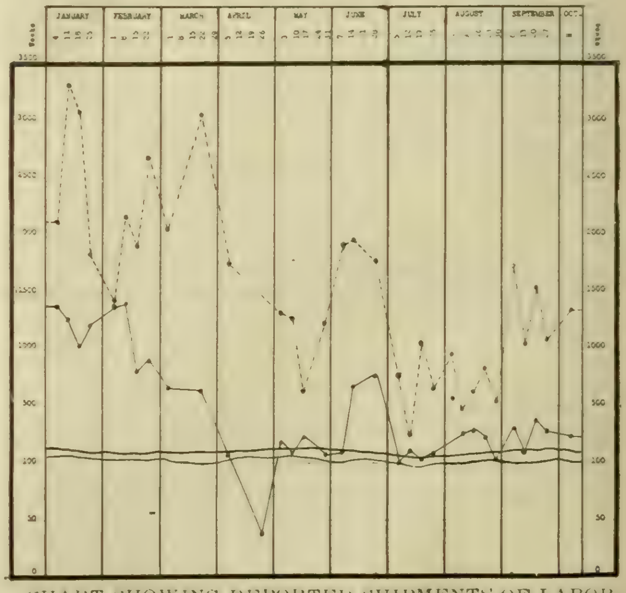


CHART SHOWING REPORTED SHIPMENTS OF LABOR, WEEKLY, BETWEEN STATES FOR PERIOD UNDER FEDERAL OPERATION, JAN. 4 TO OCT. 4, 1919.
SKILLED ———— UNSKILLED ....
FIRST COLUMN, NUMBER OF PERSONS TRANSFERRED
RECORD OF ACTIVITIES FOR WEEK ENDING AUGUST, 1920.

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Labor Efficiency

By far the most important essential for labor is efficiency, that is, the nearest possible approach to the execution of 100 per cent of each man's ultimate possibilities. Efficiency depends on willingness, ability, opportunity and direction. At present it is greatly decreased, probably from 30 to 60 per cent in nearly all classes of skilled and unskilled labor. Most of this is doubtless due to unwillingness directly caused by excessive wages and by pernicious agitation.

Willingness will be greater when the country is purged of agitators, socialists, anarchists, I. W. W.'s and other pernicious classes and when the average worker feels the necessity for himself and family; in other words, when he receives only a just compensation proportioned to his results and to general values.

Ability can be greatly increased by classification of employment, by careful selection of men for different tasks, and by manual training and various systems of education in the shop, in the field and even in the school or lecture room.

Opportunity is largely a matter of method and organization dependent on the employer, the character of the work, and the attitude of labor itself and the leaders of its unions. Organization of labor forces on the work is an important essential and requires great skill and experience for its complete success. Men should be assigned in groups to tasks for which they are best qualified, and the different groups should be carefully located and scheduled so as to co-operate to the highest degree and to avoid all conflict and delay.

Men work much more efficiently in small groups than they do either singly or in large gangs, a fact that is recognized by the statement in this issue quoted by a manufacturer's circular that "Two men shoveling together will do twice as much as when shoveling separately." The quality and quantity of work is greatly improved by promoting and maintaining rivalry between gangs who strive to excel each other through pride or to secure a promised reward.

Direction of labor requires a high degree of administrative skill and thorough knowledge of all the details of the work in hand. The work should be supervised as a whole and each element should be directed with an intimate knowledge of every detail. The men should be treated with uniform decision and justice to themselves and their employers, each being required to do a fair day's work for a fair day's pay. The separate operations should be very carefully arranged and synchronized to avoid all conflict, interference, or delay, and all materials and equipment should be ready in advance of requirements. Especial pains should be taken to direct the movements of the men in the simplest and most direct manner, cutting out all superfluous operations and especially preventing any inefficiency of part of the force causing delay to the remainder.

By adopting as many as possible of these suggestions, almost any construction job will be notably expedited and its cost correspondingly reduced.

Equipment Profits

Construction plant and equipment is either stock property of a standard character which is constantly maintained by the contractor or it is special or provided as occasion demands. Complete and accurate accounts should be kept of both, the former being classified as permanent investment and charged to overhead expenses while the latter is accounted to current work. In either case, the charges should include first cost, amortization, depreciation, maintenance, repairs, insurance, interest, storage, transportation, rental and lost time, if any.

The plant should be credited with the actual work done, with any rent received and with the inventory price or the salvage received at the end of the job or at inventory time; while it should be charged with superintendents, supplies, wages of operators and the other items mentioned.

The installation of any plant or equipment on construction work is justified first, if it is absolutely indispensable to the execution of the contract or its safety; second, if its use expedites the work sufficiently to overbalance any direct loss that may be incurred over the performance of the work by other methods; and, generally, if the total cost of the completed work is reduced by the use of the given equipment over what it would be by the best method of doing it without this equipment.

It follows that the amount of work actually performed by the equipment may be much more important in the selection of apparatus than the unit cost of performance; as, for instance, the excavation of 500 yards of earth at 20 cents per yard by a steam shovel may not be justified when a $15,000 steam shovel is used one or two days only and involves a cost of $100 or more for installation and excessive cost for removal of spoil, although the direct cost of the excavation by hand may be 50 cents per yard without any installation or extra removal costs and may be done with available forces distributed over a longer period.

In these days when labor is so costly, inefficient and unreliable, it is axiomatic that the use of power plants, labor-saving machinery and equipment are justified where the installation, operation and overhead charges are even nearly as low as the estimated labor costs, because of the saving in time and the elimination of labor troubles.

Wherever standard appliances are involved that can readily be bought and sold in open market and do not necessitate heavy permanent investment, or where they form part of the contractor's standard stock equipment, their use is justified when the overhead and operating charges are less than the cost of the force they replace and the purchase of such an apparatus is good policy when there is an abundance of work for them and the saving equals the interest and amortization charges on the investment. It is surprising how much machinery will be justified by elimination of three or four laborers.

In order to get the highest profits from equipment investment, the plant must always be under the supervision of competent mechanics, frequently inspected and maintained in perfect operative condition. Defective parts must immediately be renewed, injuries repaired, spare parts likely to be needed kept in reserve to prevent loss of time when renewed, and the machine must always be kept in perfect alignment and adjustment, well oiled and clean.

The machine and its crew must be protected from the weather and from accidental or malicious injury and the work must be so arranged as to operate the machine as continuously as possible and to its fullest capacity with the smallest crew. If movable, arrangements should be made in advance for shifting it without delaying the work or hindering its crew, and provision should be made in advance for the character and quantity of material it handles so that no obstruction or delay will occur when these are varied.

Under such conditions, with large contracts, ordinary requirements and fair prices, many machines will pay for themselves in a short time and thereafter earn large dividends for their owners. This is notably the case with excavating machinery, concrete mixers and some other kinds of plant.

Immigration Before and After the War

Yearly pre-war arrivals of more than 1,380,000 were reduced to 295,403 in 1917, reduced by emigration, and at the present time are at the rapidly increasing rate of more than 1,000,000

In the year ending June 30, 1914, there were admitted to the United States 839,755 males and 440,553 females, making a total of 1,380,308 immigrants of all classes and from all countries.

For the year ending June 30, 1913, which was wholly uninfluenced by the beginning of the war, the total number of immigrants admitted was 1,197,892.

In the year ending June 30, 1919 (the latest for which the immigration reports have been published), immigration increased to 141,132 from 110,618 in the previous year, but was almost completely cancelled by the departure of 123,522 immigrant aliens, who left this country for permanent residence abroad; leaving a net increase of population of only 20,790, and not all of this rep-

Net Increase or Decrease of Population By Arrival and Departure of Aliens, Fiscal Year Ended June 30, 1919.

	[illegible]	[illegible]	[illegible]
African (black)	5,823	976	[illegible]
Armenian	282	11	271
Bohemian and Moravian	105	412	[illegible]
Bulgarian, Serbian, Montenegrin	205	3,241	[illegible]
Chinese	1,697	2,062	[illegible]
Croatian and Slovenian	23	154	[illegible]
Cuban	1,169	898	* 435
Dalmatian, Bosnian, Herzegovinian	4	2	* 2
Dutch and Flemish	2,735	1,356	[illegible]
East Indian	68	106	* 403
English	26,889	9,406	* 17,341
Finnish	968	497	* 644
French	12,598	5,472	* 9,278
German	1,837	343	[illegible]
Greek	813	15,562	x 14,935
Hebrew	3,055	373	* 3,122
Irish	7,910	1,934	* 6,987
Italian (north)	1,236	1,195	* 1,048
Italian (south)	2,137	36,980	x 34,640
Japanese	10,056	2,127	* 3,671
Korean	77	23	* 58
Lithuanian	161	6	* 185
Magyar	52	10	* 47
Mexican	28,844	17,793	* 18,219
Pacific Islander	6	2	x 5
Polish	732	153	x 9,072
Portuguese	1,574	3,525	x 2,079
Roumanian	89	61	* 26
Russian	1,532	1,717	x 486
Ruthenian (Russniak)	103	2	* 99
Scandinavian	8,261	4,865	* 3,923
Scotch	10,364	1,687	* 10,394
Slovak	85	1,150	* 1,059
Spanish	4,224	7,489	x 3,754
Spanish American	3,092	799	* 2,316
Syrian	231	132	* 221
Turkish	18	275	x 251
Welsh	698	156	* 688
West Indian (except Cuban)	1,223	336	* 1,505
Other peoples	247	235	* 71
Total	141,132	123,522	* 20,790

resents increased labor supply, since it includes women, children and other dependents in workmen's families.

During the year, 20,643 aliens were temporarily admitted from Mexico by the operation of the Limited War Emergency Authorization, which suspended the provisions of the law regarding contract labor, head tax and illiteracy test. Of these laborers, 10,941 were engaged in agricultural work, 9,998 for railroad work, 89 for government construction work and 65 for mining. Under these provisions, from 1917 up to the termination of the exemption in 1918, a total of 29,563 laborers were admitted from Mexico, of which, at the date of this report, 9,036 had returned. The principal destinations of these laborers when admitted were Texas, 8,636; Arizona, 6,803; California, 6,382; Idaho, 1,549; New Mexico, 1,292; Kansas, 1,147. Similarly there were admitted 3,259 negro laborers from the Bahama Islands, of which 669 were employed by truck farmers in Florida and 2,590 were employed by contractors of government construction work at Charleston, S. C. Most of these have already returned to their homes.

There have also been brought from Porto Rico, under the direction of the War Department, 13,095 laborers who were not aliens and all of whom have since returned to their homes.

During the year terminating June 30, 1919, 8,626 aliens were excluded under the law or 3.5 per cent of the number applying for entry, as compared with 2.3 per cent in 1918 and 5.3 per cent in 1915. During this year 1,455 aliens were excluded for illiteracy, 514 were excluded for immorality, 436 criminals and 39 anarchists, these figures including those previously admitted and deported during the year. About 4,000 aliens (46 per cent of all rejections) were excluded as likely to become public charges.

Aliens Admitted To and Departed from the United States from July 1, 1919, to March 31, 1920.

	Immigrant	Emigrant
July, 1919	18,152	25,757
August, 1919	20,597	28,934
September, 1919	26,584	27,770
October, 1919	32,418	25,447
November, 1919	27,219	36,105
December, 1919	33,913	22,199
January, 1920	31,858	27,086
February, 1920	30,606	11,607
March, 1920	39,971	22,679

Intended Future Permanent Residence of Immigrant Aliens Admitted and Last Permanent Residence of Emigrant Aliens Departed, During Six Months Ended December 31, 1919.

States.	Immigrant.	Emigrant.	States.	Immigrant.	Emigrant.
Alabama	250	116	Nevada	248	128
Alaska	91	68	New Hampshire	1,696	644
Arizona	2,586	1,044	New Jersey	5,185	6,602
Arkansas	68	22	New Mexico	443	360
California	14,368	8,058	New York	38,093	54,077
Colorado	529	836	North Carolina	140	54
Connecticut	3,740	4,048	North Dakota	568	276
Delaware	168	261	Ohio	4,173	16,516
Dist. of Columbia	917	420	Oklahoma	233	119
Florida	1,857	1,493	Oregon	1,544	497
Georgia	258	142	Pennsylvania	7,879	24,743
Hawaii	1,425	361	Philippine Is.	7	4
Idaho	472	169	Porto Rico	267	369
Illinois	6,415	9,677	Rhode Island	2,697	2,071
Indiana	856	1,618	South Carolina	104	61
Iowa	1,003	614	South Dakota	425	135
Kansas	382	429	Tennessee	193	66
Kentucky	145	92	Texas	16,977	1,567
Louisiana	862	349	Utah	520	447
Maine	2,742	575	Vermont	1,726	322
Maryland	688	618	Virginia	1,232	299
Massachusetts	15,299	10,931	Virgin Islands	9	2
Michigan	10,799	6,149	Washington	5,704	1,638
Minnesota	2,573	1,839	West Virginia	507	1,652
Mississippi	109	51	Wisconsin	1,352	1,638
Missouri	893	857	Wyoming	224	171
Montana	779	487			
Nebraska	463	430	Total	162,883	166,212

Of the immigrants entering during the last six months of 1919, 76,048 were from Europe, 6,795 from Asia, 45,843 from British North America, 22,857 from Mexico and 11,340 from other parts of the world. Of the Europeans, 28,837 were from Italy, 12,717 from England, 3,300 from Scotland and 2,084 from Ireland, 4,794 from France, 4,366 from Portugal, 3,541 from Spain, no other country contributing more than 2,700. But during the same period, 67,371 returned to Italy and 2,750 to Ireland, leaving a net loss of those nationalities. Altogether 76,048 came from Europe and 148,325 returned there; a net loss of 72,275 Europeans.

Of 6,795 Asiatics arriving, 4,675 were from Japan and 1,295 from China; while 2,217 Japanese and 1,656 Chinese left this country, leaving a net gain of 2,135 Asiatics.

Each of the other countries gave us a net gain, only 4,404 Canadians returning home. But there was a net loss, counting all countries, of 3,329.

Examining the occupation of the immigrants arriving during the last six months of 1919, we find that 6,408 were professional men; 25,849 were skilled workers, clerks and accountants, mariners, carpenters, machinists, dressmakers, miners and unclassified mechanics, in the order named, being the largest classification; while there were 20,375 laborers, 3,970 farm laborers, 4,186 farmers, and 240 teamsters and hackmen. There was a net gain of 4,250 professional men, 14,131 skilled laborers, 2,224 farm laborers, 255 farmers, but a loss of 88,833 laborers.

Reports of immigration during the latter part of September, 1920, show the arrival of aliens from Europe at the rate of more than 20,000 per week with several days having a record of 9,000, which, if maintained, would be more than 3,250,000 in a year. It is not, of course, practicable to secure any such number, but predictions have been made that there will be 1,500,000 admitted within the next twelve months and there have already been as many as seven shiploads of immigrants anchored in New York harbor at one time waiting an opportunity to land their steerage passengers.

It is reported from Warsaw that from 500 to 1,000 Polish Jews are daily receiving passports and vises to the United States, as many as 8,000 having been in line for that purpose at one time. As there are more than 100,000,000 peasants in Russia, the supply is sufficient to keep this rate up for a long time.

Price Fluctuations

The peak has been passed here and abroad. Conditions here are superior to those in Europe.

The first instance of important price reduction since the close of the war was the voluntary action of the United States Steel Company in making a heavy cut in prices on structural steel and other products last year. Occasional minor reductions, often followed by corresponding increases, have occurred in many commodities, but in general the range of our prices, especially for food, clothing and rent, has increased continually but at a very reduced rate up to a recent period.

Last spring a conspicuous effort was made to promote reductions by large department stores in the principal cities, which made flat reductions of 10 to 20 per cent. More recently the largest automobile manufacturer has announced a large reduction which he promises will be met, if possible, by lower payments for materials rather than by a cut in wages. This was followed only a few days ago by a general reduction of 10 to 20 per cent in mail order prices applying largely to clothing, furniture and the like. In some sections of the country food has become cheaper but, although the crops have been unusually good, the consumers in the large cities, especially in the East, have received little or no benefit from this and in some cases the prices, especially for perishable articles, are still rising.

The very much belated and inefficient, not to say indifferent, efforts of the government to distribute excess war supplies to citizens have had little effect, apparently because of the imperfect distribution and guarantees and because a large amount of the supplies were acquired by dealers who immediately put them on the market at or near current prices.

The relief that might have been obtained by proper disposal of excess equipment such as automobiles, aeroplanes, large quantities of various kinds of machinery, as well as the stupendously costly camps and cantonments built as emergency construction, has been practically eliminated by the policy of neglect and even wanton destruction or of selling abroad or of abandoning or turning over to speculative purchasers at a small fraction of their cost and current value, when they might well have been maintained for a better market or adapted to remunerative commercial purposes.

PRICES BEGINNING TO FALL

Nevertheless, able financiers and trained observers unite in the opinion that the crest of high prices has been reached. The conservative **Monthly Review**, issued by the Federal Reserve Agent, New York, states under date of August 28 that within a month there has obtained a downward tendency in important commodities, such as sugar, coffee, grain, potatoes, cotton and tin, many of them being raw or semi-manufactured goods, which will not maintain the same reduction when subjected to labor charges in their route to the ultimate consumer, although all domestic indices show some decline during the past month.

Such declines are due mostly to increased actual or prospective supply through decreased demand, or to the release of speculative stocks, so that, while some prices were increasing and many were stable, the large number of important commodities that have been separately reduced indicate the increased operation of the natural laws of supply and demand. The retail prices, however, which rose more slowly than did the wholesale prices, are correspondingly slow in falling, and have not yet shown much apreciable decline.

In some instances the high prices are in no way warranted by legitimate costs, as in the case of lumber which, in the Ohio Valley, has been quoted at $50 per thousand above the price in Oregon plus transportation charges, a condition which may perhaps be due to the frantic competition of purchasers to fill present wants regardless of price.

Much encouragement should be felt from the fact that, with the exception of Japan, the wholesale prices in the United States have been constantly much lower than in any of the other allied nations. In 1914 and 1915 they showed no rise, in 1916 the rise was less than 30 per cent, in 1917 they had risen only about 70 per cent, and in 1918 about 100 per cent above 1913.

In 1919, however, when prices were expected to decline, the rise was accelerated to an increased total of about 140 per cent and continued to rise until near the middle of 1920, when it attained a maximum of about 170 per cent over 1913. But at the same date the increase was about 210 per cent for Great Britain and Ireland, 220 per cent for Japan, 475 per cent for France, and about 555 per cent for Italy. Last June, however, the French summit dropped 10.4 per cent and is now 15.6 per cent below the April peak. In Japan it has fallen 25.6 per cent below the March peak. peak.

Indexed prices compiled by the United States Bureau of Labor, the Federal Reserve Bank, Dun's and Bradstreet's, show, for the first of August, declines of 2.6, 1.9, 3.1 and 2.7 per cent, respectively, with total declines from the highest point of 3.68, 7.3, 4.2 and 9.7, respectively; the average of these declines from the high point being 6.22 per cent as compared with averages for Great Britain of 5 per cent, France 15.58 per cent, Italy 9.57, Japan 25.55, Canada 1.90, Sweden 0.5 per cent; all percentages of increases being converted to the 1913 basis.

In studying the probable relation of wages and cost of material to decreased prices, the Bank Review gives comparative diagrams of the course of prices and wages in England at the time of the Napoleonic war and in America at the time of the civil war. In England the prices declined at first rapidly and then steadily, and wages were gradually diminished but to a much less degree, for a long series of years.

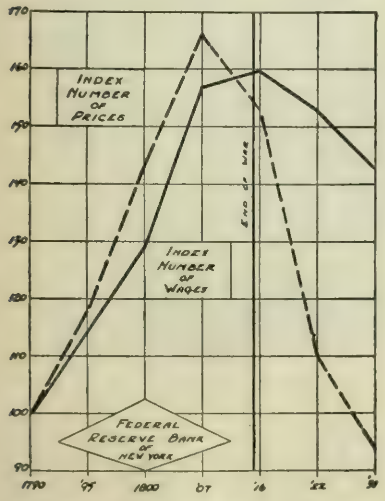
For thirteen years after the civil war prices (in currency which was worth less than gold) dropped rapidly, while for seven years wages continued to rise and then dropped for seven years on a line approximately parallel with the continued fall of prices.

Since these wars, conditions have changed so much throughout the world that a close parallel to former events cannot be predicted, and although the law of supply and demand is eventually bound to prevail, the effect of political policies and powerful labor organizations which bitterly resist wage reductions, will undoubtedly delay and reduce wage reductions and effect a permanent change to a higher plane of living available to labor with its increased earnings, while it makes greater economy and efficiency necessary to secure the increased production which alone will permanently maintain higher wages.

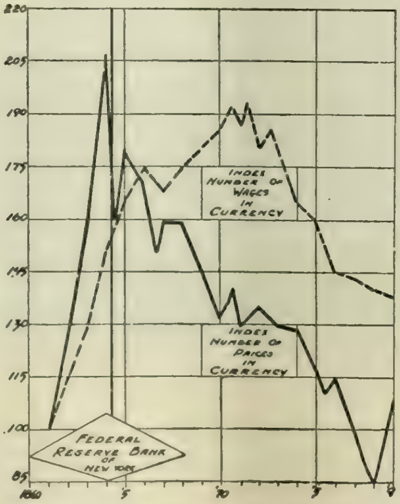
The elimination of unnecessary work and of extravagant expenditures, together with the increased supply of foreign labor, will steadily reduce and perhaps reverse the labor deficiency, jobs will be better appreciated, labor turnover will be diminished, wages will gradually fall, and above all, industry and reliability will be demanded and the unit of production of the individual will be much more closely proportioned to his remuneration. The more these two factors are balanced the larger the profits to the individual and the greater the prosperity of the country will be.

Water Power to Save Oil

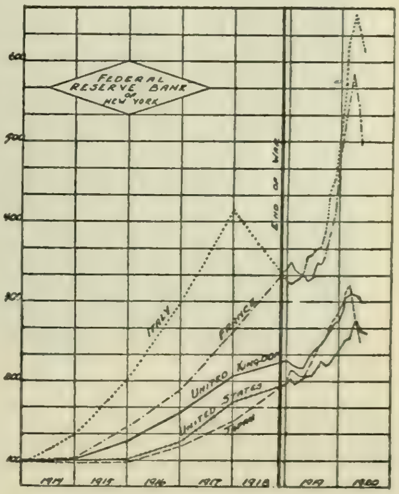
The development of hydro-electric power in California is being urged not only because of the cheaper power which it will furnish but also because the substituting of hydro-electric power for that created by fuel oil power plants will save many thousands of barrels of oil a day. The last week in August one company asked permission of the State Railroad Commission to spend $125,000,000 for the development of hydro-electric power, installing a plant with 515,000 h.p. in the mountains. It is estimated that this one plant will save 35,000 barrels of oil a day. Five power houses would be constructed and a seven mile concrete tunnel built. The company making the request is the Mt. Shasta Power Company.



COURSE OF PRICES AND WAGES IN GREAT BRITAIN DURING AND AFTER THE NAPOLEONIC WARS



COURSE OF PRICES AND WAGES IN UNITED STATES DURING AND AFTER THE CIVIL WAR



MOVEMENT OF WHOLESALE PRICES IN FIVE LEADING COUNTRIES. PRICES FOR 1913 TAKEN AS A BASE OF 100

Contractors' Equipment and Tools

Several weeks ago Public Works requested from prominent manufacturers and dealers data descriptive of new machinery or equipment or improvements on them made since January 1, 1918, for publication in this issue. Some information received in response to this request does not specify whether or not it embraces new features but is still of value to our readers. Wherever it has been definitely stated or it is evident that the articles are new or recently improved, specific mention is made in the respective descriptions, which are here presented, together with as many of the others as the space limits of this issue permit.

Road Building Machinery and Appliances

Important Road Building Machinery

By WILLIAM E. VOORHEES*

Of all the various machines used in the construction of the modern highway, the most important is the rock crusher. The scraper, the plow, the steam shovel, the paving mixer, the truck and the road roller—all of these are very necessary appliances in road building, if the work is to be carried on smoothly, economically and with any degree of speed. If none of these machines was available, however, road work could still be carried on in a limited way. But if the modern rock crusher was entirely eliminated, practically no roads under the conditions that prevail to-day could be built.

When John MacAdam, more than a century ago, conceived the method of stone road construction which still bears his name, his specifications covered stone to be broken by hand to a certain degree of fineness. But at that time labor was cheap and machinery was practically unknown, and the methods that obtained in that day are no more applicable to present-day conditions than the old stage coach and lumbering cart are comparable with the present high-powered automobile and truck.

Machines for crushing rock have been made in this country since the middle of the last century, but it has only been within the past two decades that the rock crusher has become a vital factor in the work of road building. The reason for this is that little attention was given to the question of highway improvement until the beginning of the present century. The advent of the automobile, with its increasing use, and, later, the marvelous growth in the use of the automobile

GOOD ROADS MACHINERY CO'S CONVEYOR AND CRUSHER ON THE TOBYHANNA, PA., ROAD truck, necessitated the planning for a nation wide system of hard surfaced highways.

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*Of the Good Roads Machinery Company.

The rock crusher is the most important machine used in highway construction because crushed rock is the basis of practically all types of permanent roads. Whether the roadway is a water-bound or an oil-bound macadam or a concrete highway, the bulk of the material entering into its construction is crushed rock. When labor was cheap, and stone roads were being built in a very limited way, the napping hammer was an exceedingly useful tool. Today, leaving entirely aside the matter of cost, it would be physically impossible to build even a very insignificant part of our permanent highways if it were not for the multitude of rock crushers that yearly hammer out millions of tons of material for road purpose.

Rock crushing plants, as used to-day in producing crushed material, may be divided into two classes: the stationary and the portable plant.

Where stone quarries are located along the line of a railroad, the stationary plant consisting of a large-size crusher, elevators, screens and conveyors, is used. Some of these stationary crushers are of mammoth size with openings large enough to take in a dozen tons of stone at one time. The stationary crushing outfits range in size from the small plant costing but a few thousand dollars and capable of producing from two hundred to five hundred tons per day, to the large plant costing thousands of dollars and capable of turning out several thousand tons of crushed material daily.

The portable plant usually consists of a crusher, elevator, revolving screen and stone bin, all mounted on wheels, so that the complete outfit can be readily moved from point to point. Such plants are generally located at some distance from the line of a railway and close to the job where the stone is to be used. Crushers used in connection with portable plants have capacities ranging from seventy-five to three hundred tons daily. By the introduction of high-grade steel, present-day manufacturers have been able to build portable crushing plants of large capacities, but comparatively light in weight. Such outfits usually weigh from four to eight tons.

In spite of improved methods for producing crushed stone, the present program for road construction in this country has created a situation where the demand largely exceeds the supply. It would seem, therefore, that wherever good stone for road-building purposes is available, the practically assured financial returns should be an excellent inducement for the installation either of a permanent or a portable rock crushing outfit.

Western Wheeled Scraper Company

SIMPLIFIED AIR-DUMPING DEVICE

The Western Air-Dump cars are now made with vertical instead of horizontal cylinders in the following sizes: 12-yard, 16-yard, 20-yard, 25-yard and 30-yard. The 30-yard car is made with twin vertical cylinders because of its greater size, in order to equalize the strain. The air-dumping device has been simplified. In operating, the piston head now engages directly with the body of the car through a pivoted bearing, the thrust being applied near the outer edge of the car bottom. This gives the greatest possible leverage and reduces the amount of power required to tip the bed, while the direct engagement with the car body enables the total power of the air pressure in the cylinder to be utilized. There is no power lost. This gives greatly increased dumping power with no greater consumption of air.

AIR-DUMP CAR WITH TWIN VERTICAL CYLINDERS

Forty-five-Yard Car. A 45-yard car for carrying coal is a standard 30-yard car with top boxes added, giving it a greater capacity, which is practical for the service intended.

NEW CRUSHER

The No. 0 crusher is the smallest size that this company manufactures and is made in response to the demand for a reasonably light machine that can be readily operated with an engine or motor and can be easily transported by a team or small tractor. It has a very satisfactory output.

WESTERN DITCHER

The Western ditcher is a tool designed for cutting and grading irrigation ditches. The blade has been given the correct curvature for earth cutting. It is highly polished and both edges are filled with detachable bits, easily removed for sharpening. The front end of the blade is sharp, leaving no obstruction to catch and hold grass or rubbish and thus choke operation. The blade is easily adjustable to conform to the wear on the shoe and increasing depth of the ditch. The blade is 5 feet long, easily adjusted to any angle desired. The land side is fitted with hard steel fins on both front and rear ends, on which all side draft is carried. The ditcher is reversed simply by turning it over, removing and replacing the cotter in lower end of each draft beam.

No. 4 FRESNO

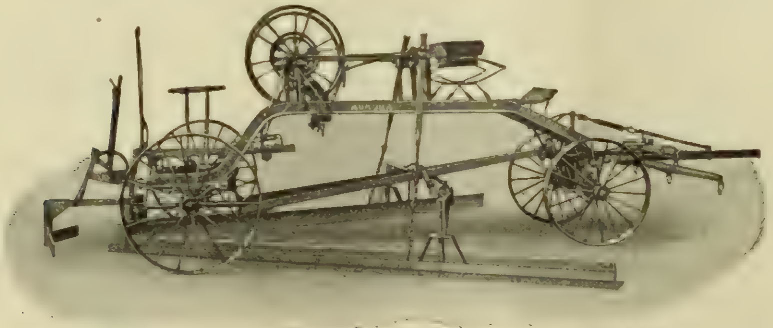
The new Fresno scraper, 3 feet long, is one size smaller than the smallest heretofore manufactured. It is of light construction suited for handling light material.

DIRT PAN CLEANER

The Western elevating grader is now fitted with a dirt-pan cleaner by means of which the operator can keep the belt from clogging. The device consists of a hand lever and other necessary parts for operating the pan scraper. Heretofore on all makes of machines it has been necessary for the operator to make frequent stops and clean off the pan with a stick to prevent clogging.

WESTERN ROAD PLANER ATTACHMENT

This consists of two 13-foot blades under perfect control, with a spread of about 16 feet. Each blade has two shares, on both edges. Immediately behind the rear end of the blade is an adjustable spreader under independent control. The blades are spread by moving the machine forward, after they have been lowered. The device can be fitted to the frame of a road grader by the removal of the blade mechanism, thus quickly converting the grader into combination leveler and drag, which in a single trip of the road will do the work of 6 men, 12 horses and 6 drags.



ROAD PLANER FITTED TO ROAD GRADE FRAME

WESTERN MIDGET GRADER

The Western Midget grader is a one-man, two-horse machine, with a five or six-foot blade and weighs about 1,000 pounds. It has practically the same adjustments that are found in the larger machines.

WESTERN BATCH BOXES

Recently the Western Wheeled Scraper Co. has added to its line of road-building equipment Western batch boxes, Western road builders, trucks for carrying batch boxes, industrial railway and Western service cars for carrying the rail sections. The batch boxes are built both of oak and of steel and are of approximately 1 cubic yard and 2 cubic yards capacity. These boxes discharge their loads through bottom doors into the mixer. Boxes are made with one compartment for both aggregates or with three compartments, for sand, cement and gravel, respectively.

WESTERN ROAD BUILDERS TRUCKS

These trucks are furnished for carrying batch boxes from the material yards to the mixer. One or two batch boxes, according to size, fit on each truck. The truck is of very strong construction throughout. It is readily convertible into a V-shape dump car by attachment of the arch supports and the body, parts being supplied for that purpose. The ends of the truck frame are built up with steel plates at the top and bottom, to give rigidity, enabling the car to resist bumper shocks. Capacity, three tons; gauge, 24 inches.

Heltzel Steel Forms

Steel forms made by the Heltzel Steel Form & Iron Company are designed for the construction of roads, pavements, highways, curbs, sidewalks, gutters, cisterns, sewers and manholes. They are made in various standards, for integral curb and base, for straight, battered and curved curbs, for combined curb and gutter and for special construction.

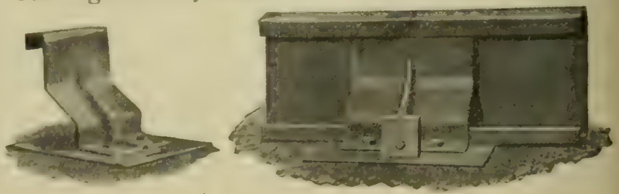
Heltzel rails are especially designed for use under automatic tamping and finishing machines. They are made of the highest grade, extra heavy, open hearth steel, fortified with additional depending flanges at both top and bottom. This construction insures the special strength and rigidity necessary to withstand the weight and pounding of most finishing machines. It provides a bearing surface which ordinary rough treatment will not dent or buckle, causing waves in the road surface. The top flange is 2⅛ inches wide; the bottom flange is 4 inches wide, giving an extra large bearing surface and meeting all state specifications.

REVERSIBLE DITCHER WITH 5-FOOT BLADE

Besides the broad bottom flange, the rails are supported by a pedestal, which is an exclusive Heltzel feature. It gives the rail double direct support. The rail will not lean or buckle under the vibration of the machine. Creeping is prevented by a flat stake, which anchors the pedestal. The broad 7 x 10-inch base plate of the pedestal prevents sinking in marshy soil.

Rail junctions are also formed by the pedestal. One is placed between each two rail ends, and they butt together over it. This provides a simple, effective joint, instantly connected without hammering. Support is provided where most needed. All extending lugs, clips and attachments to the rail are eliminated. Two pedestals and two stakes are included with each rail.

In the integral curb and base form, the back rail hangs on an adjustable stake that gives instant grade adjustment within ¼ inch by means



HELTZEL WIDE BASE RAIL JOINT AND SUPPORT of a sliding clip. The rails are made in 12 foot sections slotted every 6 feet for division plates, and connected with tight, smooth joints made with a sleeve. The division plates prevent the rails from spreading under pressure of the concrete, and can easily be removed with a hook before the rails are stripped. Where division plates are not used, special overhead hangers are substituted for them.

The integral curb, gutter and base forms can be made of different dimensions by using special pieces combined with standard rail forms.

Straight curb forms are built up with pairs of double flange standard rails hung on adjustable steel angle stakes and can be set up with cheap labor in a fraction of the time required for wooden forms. They cannot spread at the bottom, and thus prevent loss of concrete. The cost of finishing the concrete is reduced 50 per cent by the smooth surface left when the steel is stripped.

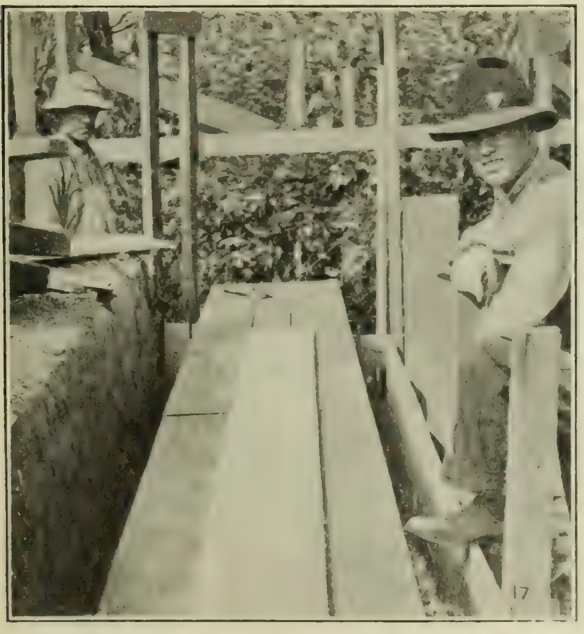
The Heltzel "Lightning" car unloader is a steel chute closed at the lower end and provided with hook brackets by which it is attached to the side of a gondola car. It can be filled by shoveling while the trucks are absent and can load the latter immediately by opening the lower door, thus economizing time both for the shovelers and the trucks, a feature which saved 27 minutes per load and effected a labor economy of $12.45 per day for George Geisel, street commissioner of Rahway, N. J. The unloader can be handled and installed easily by two men. The angle is adjusted by a controller lever and the steel door is operated by gravity. The unloaders are built in a 1-yard size weighing approximately 385 pounds and in a 1½-yard size weighing approximately 410 pounds.

The same company makes a steel strike-off with long guide handles at each end resting on the steel forms for concrete pavements. They also make the Parrish double beam template with two I beams curved to the crown of the road and carried by rollers engaging the steel side forms. The template is hauled forward by the concrete mixer and distributes the mortar evenly over the wet concrete.

Another road-building appliance made by the same manufacturers is a steel bulkhead with the top reinforced by a riveted angle-iron flange. The bulkhead is held in position by three patent pedestals having plates that extend into and under the concrete and are staked down by flat steel pins and are easily withdrawn after being used.

Bilger Steel Culvert Forms

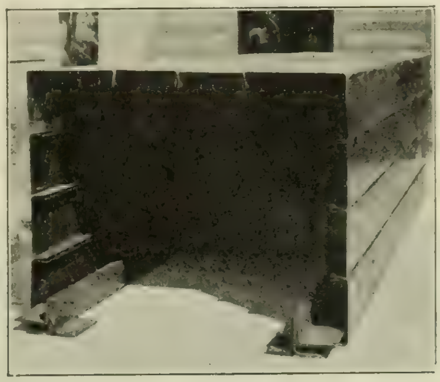
The Bilger steel forms are a permanent equipment, and are used in place of temporary and costly lumber forms in the construction of concrete culverts and bridges in highway, railway and other improvements.



PLANK OUTER WALL ON ONE SIDE WHERE EARTH CAVED IN. TEMPORARY PLANKS ON SLIPPERY TOP PLATES

The forms are entirely free of castings, being made only of structural steel angles and plates, any part of which could easily be repaired by a country blacksmith.

The design is strictly of the one-man type. A complete form for a 3-foot square culvert 36 feet long, for example, can be set up ready for the concrete, or can be collapsed and removed from the completed culvert, by one ordinary laborer in 30 minutes.



FORM ASSEMBLED

The forms consist essentially of only three parts, namely, base angles, cover plates and centers. All base angles are alike, symmetrical and interchangeable to any position and to every size culvert the forms build. Likewise, all cover plates are alike, symmetrical and interchangeable to every size culvert the forms build, and also to either the side or top position of each size culvert.

There are no small parts to become lost, nor large parts to require more than one man; no duplication of parts to make the forms expensive, nor rights and lefts to puzzle the mind; nor are there any gears, levers, turnbuckles, cams, springs or other mechanism to become clogged with concrete or mud.

By a revision of the design of the centers, these forms now build on the foot and the half-foot any span, any height, and any ratio of span to height between the limits of 18 inches and 12 feet without any duplication of parts.

The forms are collapsed from either or both ends from the outside, merely by striking the projecting ends of the base angles with an axe or maul, driving them some 4 inches along on the concrete base. When the notch in the base angle comes under the center, the center drops, bringing the hooks out of the holes in the flanges of the cover plates, and the entire form is released at once and can be taken from the completed culvert piece by piece.

Every set of these Bilger forms is manufactured and guaranteed to build as many culverts as there are on any 100 miles of highway in America, and at a cost for the forms of less than one dollar per culvert built. The forms are manufactured by the Highway Culvert Form Co.

The Scraper's Part in Road Work

By F. R. BUMPUS

Road machinery has kept pace with the development of various other lines of machinery. Not so many years ago "road machinery" meant perhaps a grader that could perform no other work than the grading of roads. To-day road machinery ranks among the most important products of American manufacturers, and perhaps more money is expended each year for the development of road machinery than in any other single industry. Road building has become an industry. It is no longer a side issue with the farmer, who once was the chief road builder of the nation, but to-day counties and states bid for experienced engineers and pay big money in the building. Roads are under supervision of men who devote their entire time to that and that only.

TRAIN OF ROYTRAC SCRAPERS HAULED TANDEM BY HOLT TRACTOR ON ROAD GRADING WORK

To keep pace with the evolution, manufacturers found it necessary to give these new road builders machinery that the road builder of yesterday never dreamed of. The general use of the tractor demanded an engine grader, and it was finally produced, but not without overcoming difficulties in construction.

Perhaps the greatest evolution was in the wheel scraper. It was some twenty years ago that Smith & Sons Manufacturing Company developed the platform wheeler, or the one-man wheeler, as it is popularly known. At that time it was never thought that a greater improvement could be made in the wheeler. To-day this same company is producing the Roytrac, a tractor wheel scraper built in units, depending upon power requirements. This is being adopted by industries using earth as a raw product—such as cement and brick manufacturers.

The development of the tractor wheeler became necessary for two reasons: the ever-increasing demand for faster work, and the cost of labor and the inability to secure labor. The American Cement Plaster Company was first to realize the industrial possibilities of the tractor scraper and installed two units at its Acme, Texas, plant. The superintendent of the plant says:

> We are using two units, each consisting of one Holt five-ton tractor and three No. 3 Roytrac wheelers, and they are putting in the same amount of work as twelve wheeler teams would do.
>
> At the time we purchased the first of these machines we worked one of our best wheeler teams against the engine. The wheeler team was a fast team of horses, weighing 1,400 pounds each, and they pulled a No. 2 wheeler, 1 loading without the aid of a snatch team. The engine pulling three No. 3 Roytrac wheelers would make about four trips to the team's three. This will give a fair comparison of the amount of dirt handled with the team and machines, both making the same distance.
>
> We are today putting in the same amount of dirt (400 yards) with four men, where we formerly used twelve. These beds are excavated to a depth of 12 feet, and the dirt is hauled about 1,200 feet to a trap.
>
> The prime reason for adopting this method was the inability to get men that knew how to drive and care for teams, the high cost of feed and extreme high wages we had to pay drivers.

Pressure Cylinder Scarifiers

In the construction and maintenance of improved highways, the loosening of the old road surface for excavation or resurfacing is often one of the most expensive items of cost and amounts to a very high figure if attempted by hand picking.

Nearly all of this expense can be eliminated by the employment of a pressure cylinder scarifier attached to the roller used on the job. One of them is capable of loosening a mile or more of road surface in less than a day. The saving over hand picking will pay for the cost of the scarifier in the first few days used. The cost of operating a roller with scarifier is not appreciably greater than that for a roller not so equipped, as the

PRESSURE CYLINDER SCARIFIER IN OPERATION

roller operator also controls the scarifier, steam for which is taken from the roller boiler.

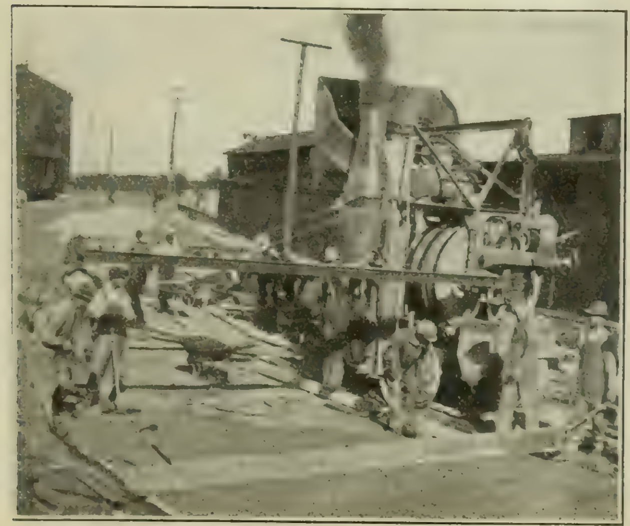
New Buffalo-Pitts and Kelly-Springfield rollers can be purchased with scarifiers attached, or the scarifiers can be bought separately and put on to old rollers already in service.

The 1921 Rex Paver

The construction of the improved Rex concrete paving machine is provided for in the new Milwaukee plant built by the Chain Belt Company. Among the special advantages derived from the new features of this machine are the power-operated discharge chute and the positive, instantaneous action which shortens the time required for discharging mixed concrete from the drums. The drum is driven by clutches that can be engaged or disengaged by a slight motion of the operating lever in 2½ seconds to provide for the charging or discharging of the drums, thus making increase yardage possible.

In order to eliminate the expense and delay of providing planks or other tracks on which to move the advancing machine, it has been equipped with caterpillar traction that expedites and simplifies the movement and by reducing stresses in the frame of the heavy machine tends to increase its life.

A derrick, which is special equipment, is provided to handle batch boxes or aggregate and is installed on the paver in such a manner that its truck will drag parallel with the paver's steering wheel without in any way affecting the three-point suspension of the paver.



REX PAVER OWNED BY GRANT SMITH CO., ST. PAUL, AT WORK AT RED WING, MINNESOTA

The loading and dumping of the bucket is under ordinary control, thus relieving the operator of routine work and permitting the production of heavier concrete and more of it. The filled bucket travels away from the mixer by the operation of a clutch and the engagement of the return clutch releases the drop doors of the bucket, automatically returns the bucket for the next batch and closes the doors without attention from the operator. The operator can place the contents of the buckets anywhere within the length of the 20-foot boom or the swing of a 180-degree arc thus covering a large area that reduces the number of movements required for the advance of the machine.

The transmission mechanism is designed for the severest service and is made of heat treated steel alloy gears, hammer forged, nickel steel shafts operating in oil baths and is protected by being enclosed.

On the Du Pont highway in Delaware, W. P. McDonald & Company of Philadelphia laid up to 614 feet of 14-foot roadway a day with one Rex paver, the first of the 1921 type. The Du Pont representative had insisted that two machines be used to finish a 10-mile stretch on time. He had just come from a job where, because of repeated delays for adjustments and repairs, it took two pavers of another make to maintain the required 425-foot daily average. With the single Rex paver the McDonald company not only averaged 450 feet daily, but also demonstrated the stand-up ability of the paver by running continuously from the day they started this job until the day they finished without losing one minute by fault of the machine.

Root Spring Scrapers

Scrapers manufactured by the Root Spring Scraper Company are designed for attachment to trucks or trolley cars to keep the roads in condition in summer-time and to clear them of heavy snow in winter. They may be used either on country roads or city streets.

The standard size for trucks is 10 feet long. For installation there is required about 20 inches clearance below the bottom of the truck frame. The plates are 12 inches wide and are provided with five steel springs. They are operated from the driver's seat by a windlass and chain, which raise and lower the scraper according to the pressure desired by the operator. They are equally efficient for handling sand, gravel, and light or wet snow, and do not require change after being adjusted to the given conditions.

These scrapers are used by about sixty railroads and street-car lines. The No. 6 is stated to save half the expense of handling snow and operates at the same cost and with one-half the power of a sweeper.

Tractors and Trailers

Little Giant Tractor, Rotary Grader and Ditcher

The tractors made by the Little Giant Company are especially recommended for road construction service, great care having been exercised to design them for simplicity, efficiency and strength. They are made in two sizes, developing 16 and 26 draw-bar horsepower.

ONE OF FOUR LITTLE GIANT TRACTORS OWNED BY COOCHICHING COUNTY, MINNESOTA, HAULS TRAIN OF SIX DUMP WAGONS

They are operated with kerosene, gasoline, alcohol, naphtha or motor spirits. The power plant is a complete unit giving a short-coupled, straight-line drive that delivers 76 per cent of the motor power to the draw-bar. The oil system is a combination of force feed and splash system. The drive wheels are of heavy steel construction, each running on two sets of Hyatt roller bearings. The steering gear is of the automobile type with foot lever brake. All gears are of high-grade alloy steel and all castings are of high-grade semi-steel. When required, the tractors are furnished with extra equipment of Presto-lights with adjustable 10-inch locomotive-type reflectors, draftometer, air cleaner to remove dust, etc., from the motor, and drive-wheel extension rims that can be quickly attached to the drive wheels to provide additional traction surface.

The draw bar has a low hitch from in front of drive wheel axle, pulling through heavy coil spring in dust proof cylinder which prevents shock to tractor or its load, eliminating side draft by means of specially constructed rear draw bar guide.

The Magneto is high tension Kingston driven bl gear, with antikick devise and impulse starter. Can crank motor with spark control open without personal danger. No batteries required.

The Governor is gear driven and extremely sensitive.

The brake is of the Automobile contracting foot lever type, handy to a driver's left foot, operating on outside of case in differential gear housing, a dust-proof case.

One of these tractors hauls a train of six dump wagons for Coochiching County, Minnesota, another hauls an 800-pound steel drag owned by the city of Owatonna, Minnesota. In Mankato a Little Giant tractor hauling a Little Giant rotary grading ditcher built 300 feet of street in forty minutes.

The Little Giant rotary grader and ditcher, constructed on different plans from those hitherto used for road-building machines, first breaks the soil by a steel mold board and share plow mounted on front and rear wheels that guarantee light draft and smooth, steady operation. The loosened earth is deposited on a tilted revolving platform composed of hinged steel elevator cups that are carried to the opposite side of the machine and elevated by the dump wheel, which distributes their contents in an even, continuous stream on the road-bed at any desired distance from 5 to 10 feet from the plow.

The soil is moved the same distance whether the machine is operated on level ground or on the side of a steep grade, and regardless of the kind or condition of the soil. The machine leaves the road in a finished condition fit for automobile traffic without harrowing or dragging. Adjustment of depth or width of cut or width of discharge are easily and quickly made by the driver without leaving his seat.

The machine has a capacity of 200 to 300 cubic yards per hour and weighs about 4,000 pounds. It is efficient for making irrigation ditches and connecting laterals and for cleaning or rebuilding them.

Case Tractors for Road Work and Heavy Hauling

Tractors manufactured by the J. I. Case Threshing Machine Company have been used with satisfaction for removing material from steam shovels, for heavy hauling, and for road construction operations, as is indicated by the following letters to the builders from some of the purchasers of the tractors which announce saving of 50 per cent in the cost of work done by them.

M. L. Jacobs, superintendent of quarries, Bethlehem Mines Corporation, writes:

> Your dealer, Mr. Ruth, at Wernersville has asked us for an expression of opinion relative to the Case Tractors which we have recently installed at our Lebanon quarry, and which we are using to haul dump wagons on a quarry stripping operation.
>
> We have had these machines in operation for more than a month and so far they seem to justify our expectations as to economical operation and satisfactory performance under all conditions. We find that we have been able to reduce our hauling cost approximately 50% and to increase the loads on the wagons. We also find that one tractor does the work of 4½ teams and does it under nearly all conditions of weather.
>
> There are some days, after heavy rain, when it is necessary for us to take off one wagon, but under ordinary conditions we haul three dump wagons, each loaded with 1½ yds. of stripping dirt. We feel quite well pleased that we have gone ahead and installed these tractors ,as results are so satisfactory in every respect that our judgment is vindicated. A great many people told us before we installed tractors that they would not do the work, but we are more than satisfied and believe the results speak for themselves.
>
> Since installing the tractors, our stripping operation per yard has been just cut in two, which I belive is the final answer to any proposition of this kind.

Emory L. Johnson, of Isaac G. Johnson & Co., New York, says:

> You doubtless will be interested to know our experience with one of your Case 10-18 tractors. We have had this machine in operation in our plant for the past two and one-half years and have been very much pleased with it. The service in a steel foundry is severe and the tractor has performed well. Outside of the thorough overhauling which we gave it about six months ago, we have had no trouble to speak of. The rubber tires with which you supplied us are still on the machine and we expect a great deal more wear from them.
>
> The major part of this machine's work is to haul slag and refuse material to our dump, although it is used somewhat around the foundry. I would say this has replaced the service of three teams and twenty laborers.

F. M. Goode, road engineer, says, under date of April 24, 1920:

> The Levy Court of Kent County recently bought one of your 22-40 tractors for road work, and it has proved very satisfactory in every detail. With the tractor we are able to do at least twice as much work in a day as we could with a steam engine. We find it more economical, as it does away with hauling coal and water and is always ready to work.

Pioneer Tractors

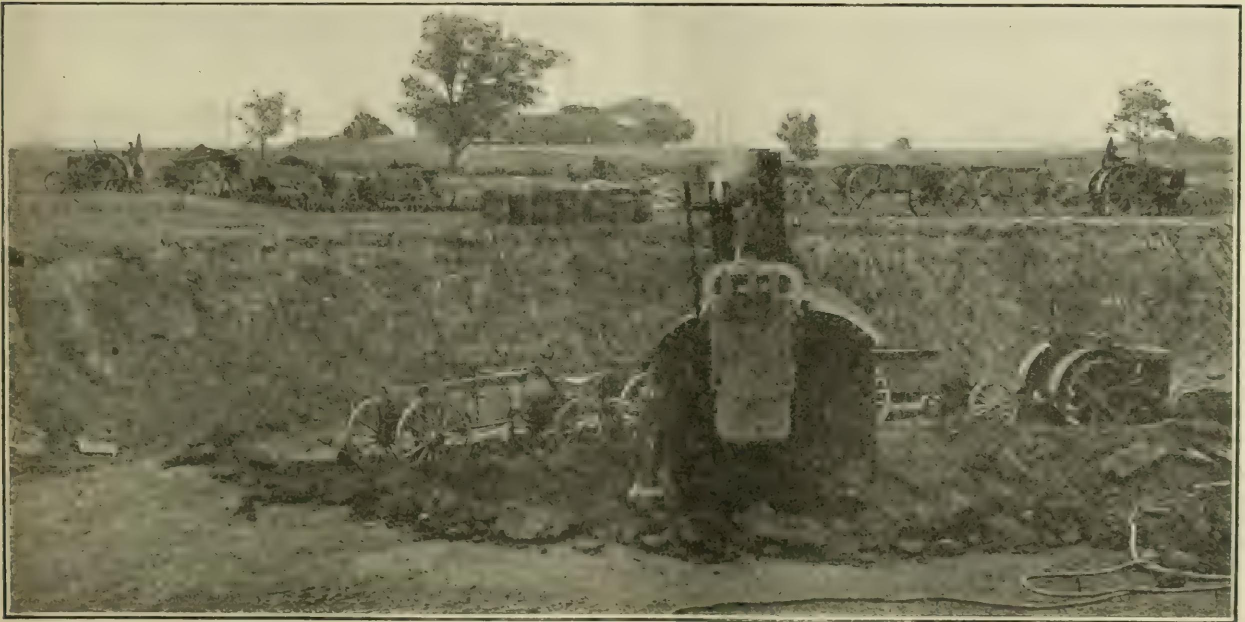
The Pioneer tractor, which has been used for road construction for several years, has recent improvements in the type known as the Pioneer 30-60, a large number of which are now being sold to counties and road builders for road work.

The tractor is equipped with a heavy-duty motor that develops 75 h. p. on the brake and 40 h. p. on the drawbar. This motor is very accessible and unusually free from vibrations.

The tractor has three speeds forward and reverse, with ample power for handling a 12-foot grader, any kind of road surfacer, or elevating grader. The tractor is used in pulling stumps and handling rock, etc., in the clearing of highways.

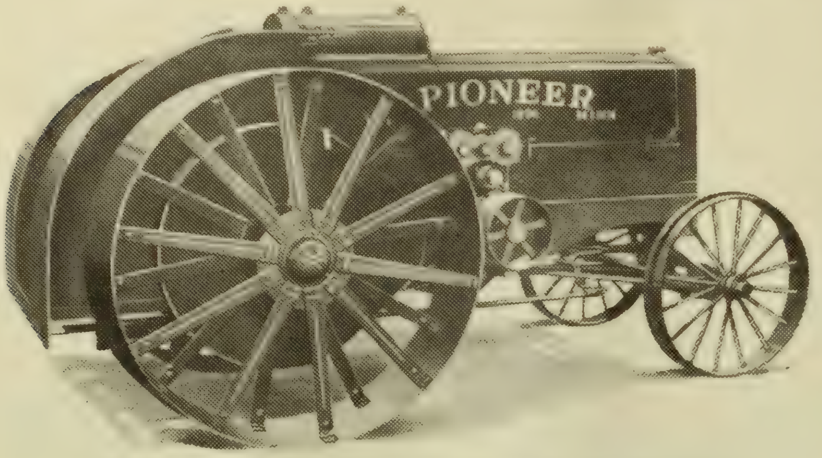
The drive wheels are 8 feet in diameter with 24-inch tires, with provision made for attaching an additional 12-inch extension.

A comfortable cab, containing all the operating levers, is provided for the operator, and is equipped with a regular automobile steering de-



CASE TRACTORS DRAWING DUMP WAGONS IN TRAINS OF THREE, OUT OFSTEAM SHOVEL PIT vice, which makes steering of this big machine exceptionally easy. The machine has powerful traction for its weight of 24,000 lb.

After one of these machines had given a road building demonstration in Pulaski County, Missouri, the county purchased a machine, afterward another, and in 1920 purchased seven, which have been used for constructing a large amount of road work that would not otherwise have been built in that country.



POINEER TRACTOR, SUITABLE FOR HAULING TRAILERS AND ROAD BUILDING MACHINERY

The Pioneer Tractor Company realized the demand for a light tractor with lots of power to be used for light road construction and road maintenance. With this type of engine in mind, they built what is known as their 18-36.

Counties and road builders have bought many of these engines and they seem to fill a long-felt want. Like the 30-60, this tractor has three speeds forward and reverse, with ample power for pulling an 8-foot grader, any kind of road surfacer, or drags. The drive wheels are 5 feet in diameter with 18-inch tires. All gears are cut from steel blanks, hardened and run in an oil bath. The journals are all equipped with Timken roller bearings, which cuts friction down to the minimum. The machine has unusually powerful traction for its weight of 6,200 lb. It handles very easily, being equipped with a regular automobile steering device, which permits it to turn in a circle of 12 feet radius.

The J. T. Tractor

The J. T. tractor, built by the J. T. Tractor Company, has full crawler traction, thereby permitting it to work on hillsides, in swamps, and on any soft or irregular ground, also to turn in a short radius. The crawler shoes have a combined area of 1,628 square inches, reducing the 7,600-pound weight to the pressure of only 4½ pounds to the square inch.

The tractor has three speeds forward and one reverse, and its power is developed by a valve-in-head, full-force-feed lubrication motor with a 4¾-inch bore and 6-inch stroke.

For road building it has made high records in handling scrapers, ditchers and three Maney graders in tandem. On the belt pulley it develops 36 h. p. to operate the sawmill, rock crusher, screen, concrete mixer and other equipment.

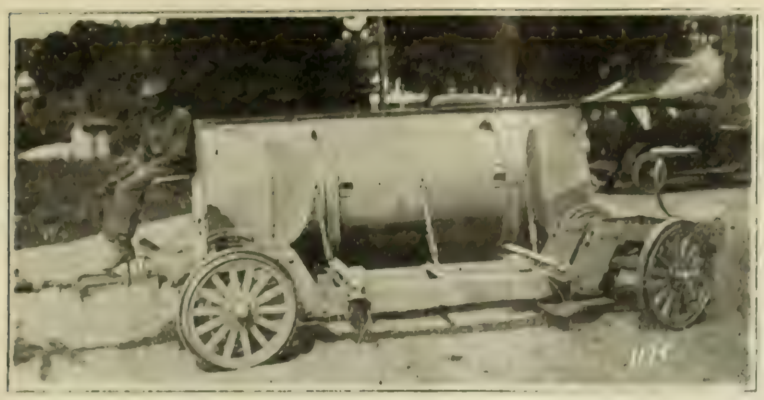
Highway Trailers

The two and four-wheel trailers of 1 to 10 tons capacity that are manufactured by the Highway Trailer Co. have been used to great advantage in the construction of the 100 miles of large concrete aqueduct recently completed for the water supply of Winnipeg and adjacent towns.

A fleet of six 6-ton four-wheel reversible trailers, equipped with 3-yard two-way steel dump bodies hauled daily sand, gravel and dirt. The equipment paid for itself many times over through the savings effected in connection with motor trucks.

A new type of trailer chassis equipped with a two-way steel dump body is suitable for hauling garbage, ashes and other city refuse. This is also a unit that can be used by contractors for haul-

J. T. TRACTOR, OWNED BY McLINDEN & DUNNE, CANTON, O., MOVES 60 YARDS OF EARTH 800 FEET PER HOUR WITH CREW OF TWO MEN, REPLACING FIVE MEN AND SIXTEEN HORSES



HIGHWAY TRAILER WITH DROP FRAME AND TANK

ing sand and gravel. The body, when mounted on the trailer, has a loading height of 60 inches from the ground, thus making the loading an easy matter.

This trailer is also furnished with a tongue equipment, making it possible to use teams in the collection of garbage and ashes. The trailers are gathered at some central point and are carried to destination in trains of four or five trailers by a motor truck or tractor.

Holt Tractors for Road Work and Snow Removal

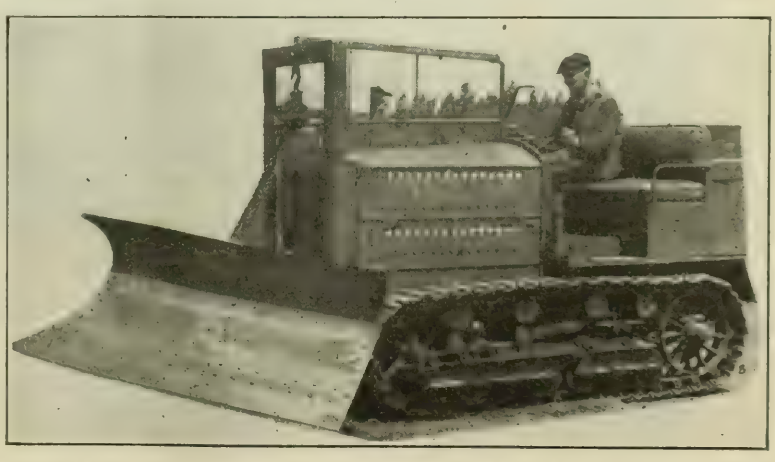
Caterpillar tractors made by the Holt Mfg Company are used in road construction for hauling trucks and trailers and for heavy snow removal work.

A convincing demonstration is afforded by the use of 5-ton and 10-ton tractors employed by S. M. Timberlake, Indianapolis, for grading the Keystone road, where they were used not only to haul the elevating grader machine, but also to pull trains of loaded dump-cars moving continuously alongside the grader at the same speed and receiving and disposing of the excavated material. The two 5-ton tractors actually replaced six team each. They hauled the dump-wagons in trains of three wagons each, one train being loaded while the other train was hauling away spoil and returning ready to serve the grader as soon as the other train was loaded.

On a road contract executed by H. H. Hannenkrat, Kansas City, Mo., cuts and fills were made by a caterpillar land leveler hauled by a 10-ton caterpillar tractor. The land leveler operated by one man carries and distributes the dirt, replacing six men and teams with slip scrapers or blade graders. The tractor and leveler with two men can move from 300 to 500 yards of earth 500 feet in ten hours. A smaller size leveler hauled by a 5-ton tractor will move from 200 to 300 yards of earth with two men in ten hours. Caterpillar tractors may be equipped with a winch mounted on the front of the machine, which is found useful for a great variety of construction operations and is particularly valuable in logging work, where it is a great labor saver in snaking logs out of deep water, towing rafts and operating lines is places where other power is not available.

The ability of the caterpillar tractor to go anywhere, over deep snow drifts or on asphalt streets and still maintains a positive footing for traction makes it very successful for snow removing operations. A 5-ton caterpillar tractor equipped with a blade type plow is especially adapted for clearing town and city streets of snow, moving it to the curb or into manholes. When equipped with a locomotive type plow it is suited for opening deep drifts on country roads.

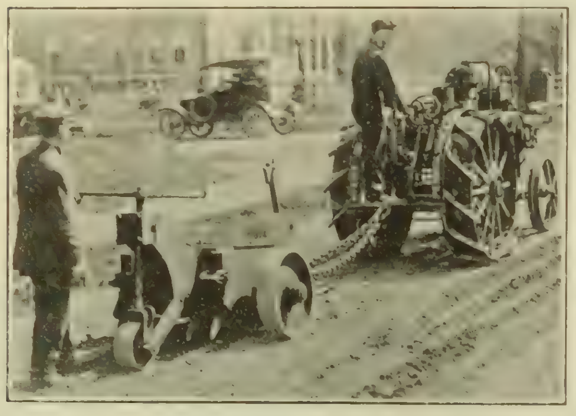
SM TIMBERLAKE, INDIANAPOLIS, REPLACED 12 MEN AND 12 TEAMS WITH TWO 5-TON HOLT TRACTORS AND TWO MEN

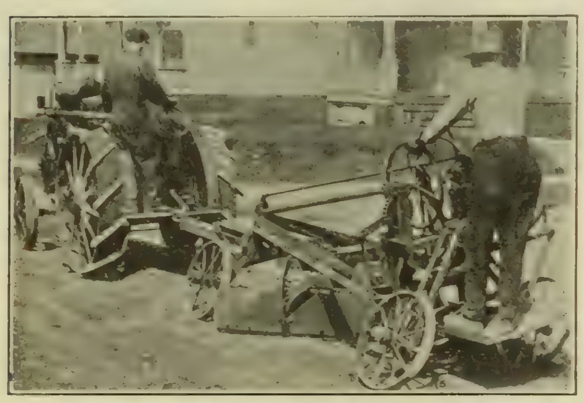


HOLT TRACTOR WITH SNOW PLOW ATTACHMENT ADJUSTED FOR USE

Avery Road Tractors

The Avery special tractors, designed for road work and built by the Avery Company, are made in five sizes, 12-25, 14-28, 18-26, 25-50 and 48-80 h. p. They are equipped with patented sliding train transmission and with a motor that burns kerosene or distillate. They are provided with a special draw-bar hitch made of angles that enable them to be attached to a grader or other road machine in any position. They may also be equipped with a special road roller 32 inches in diameter with three, four and five sections 13½ inches long.


8-16 H.P. AVERY TRACTOR HAULING SCARIFIER AT WEST LAFAYETTE, INDIANA


8-16 H.P. AVERY TRACTOR HAULING SMALL BLADE GRADER AT WEST LAFAYETTE, INDIANA

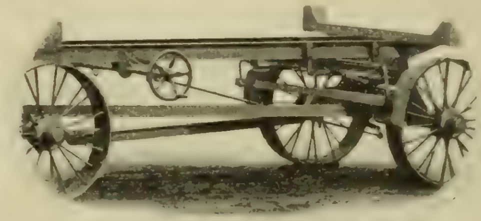
Among the principal advantages claimed for the tractors are the even distribution of weight between front and rear wheels, unusual power and economy, accessibility and simplicity of parts, a short turning radius and great reliability and durability. The tractors are efficient for hauling trucks, wagons, scrapers, grading machines, drags, scarifiers, planers, levelers and other road-building machinery, single and in multiple.

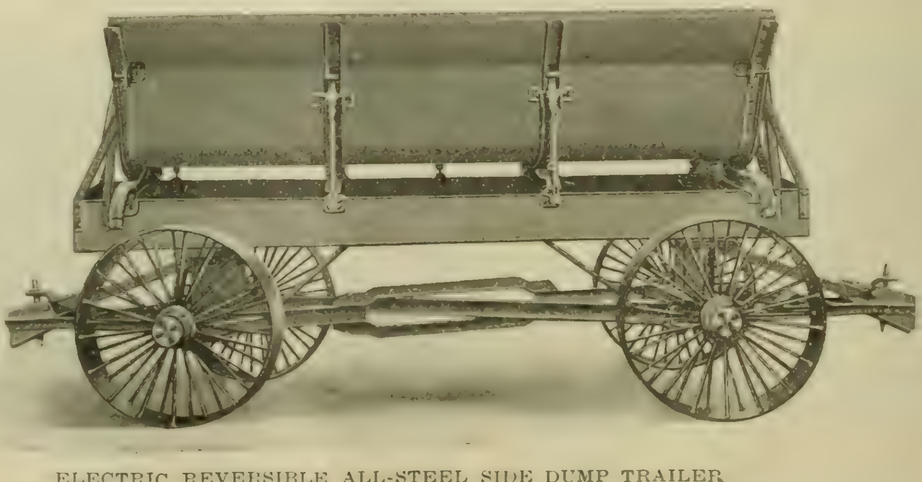
J. C. Miller, commissioner of Dallas county, Texas, writes: "For the 37 days the tractor has been operated, 56 miles of road has been graded at a cost of $444, which, under the old method, would have been $2,800. We have reduced the cost of road grading to less than one-sixth of what it was formerly." J. S. Yeager, Putnam, Texas, says: "As to building roads, we can build them for less than one-third what we could do the same work with mules and much better. We can build roads for about $15 per mile against about $60 with mules."

Electric Tractor Trailers

Bulletin 70 of the Electric Wheel Company illustrates and describes heavy-duty, reversible, all-steel trains for general, industrial and highway transportation with slow-speed tractors designed to meet the demands of highway transportation with high-powered pulling units over good and bad roads. Especial attention has been paid to securing perfect tracking, easy coupling at any angle, reversing of each and every trailer without change of couplings, improved draw-bar springs, convenient lubrication and dust-proof roller bearings.

The all-steel cross reach construction was designed and built especially for severe demands of train use with traction engines and is fully revers-


BRAKE WHEEL, EASILY ACCESSIBLE FROM SIDE OF ELECTRIC TRAILER


ELECTRIC REVERSIBLE ALL-STEEL SIDE DUMP TRAILER

ible on either straight or curved lines. Bolsters are approximately flush with outer edge of tires and have at each end a large hole for chain binders. The brakes are operated by hand wheels on the sides of the trailers.

They are made in five sizes of 6, 8, 10, 15 and 20 tons capacity, weighing, respectively, 4,000, 4,400, 5,300, 6,000 and 7,000 pounds. The wheel base varies from 12 to 16 feet and the track, center to center of tires, from 5 feet 9 inches to 6 feet, according to size of trailer. The trailers are made with full or skeleton platforms or with complete bodies, as ordered.

They can be hauled in trains of any length on any roadway that is wide enough for the tractor itself because each trailer will follow exactly in the tracks of the tractor regardless of the number of turns.

Referring to this important feature in answer to an inquiry by the editor, the Electric Wheel Company writes:

> "Concerning the trailing qualities of this trailer, would advise you are entirely correct in assuming that when the tractor makes a right angle turn every trailer will make the turn at the same point, that is, every wagon will turn the corner in the exact track made by the first trailer. This is due to the coupling and steering mechanism and is worked out to accomplish that result, making it possible for the tractor driver to proceed with his train without any anxiety as to the train following, knowing that the train will follow wherever he has driven his tractor. He need give no attention whatever to steering the trailers in the train."

Side dump trailers are built of 3½ and 5-yard capacity (5 and 7 tons), weighing 4,400 and 5,900 pounds, respectively, of all-steel construction. The body dumps by roller motion entirely by gravity, without complicated power devices for tilting or lifting, when the locks are released, and easily rolls back into position when empty. The 3½-yard body is 9 feet long, 6 feet wide and 85 inches above the ground. The 15-yard body is 11 feet long, 6½ feet wide and 88 inches high.

For use with smaller tractors, there is supplied a 4-ton, all-steel, reversible trailer possessing most of the qualities described for the heavy-duty trailers. These can be provided with bodies having an A-shape bottom and long sides hinged at the top, allowing the load to be dumped by gravity on both sides when the locks are released.

For occasional heavy hauling, the tractor wagon with solid steel axles and steel pipe reach 16 feet long, with swivel coupling adjustable to different lengths, is recommended. It is made in five different sizes of 6 to 20 tons capacity, those up to and including 10 tons being equipped with combination tongue for team or tractor, and the heavier ones with a tractor tongue. The bolsters and some other parts of the framework are made of selected oak, heavily reinforced. A similar wagon, but ol all-steel construction is for use with a tractor where trains are not desirable.

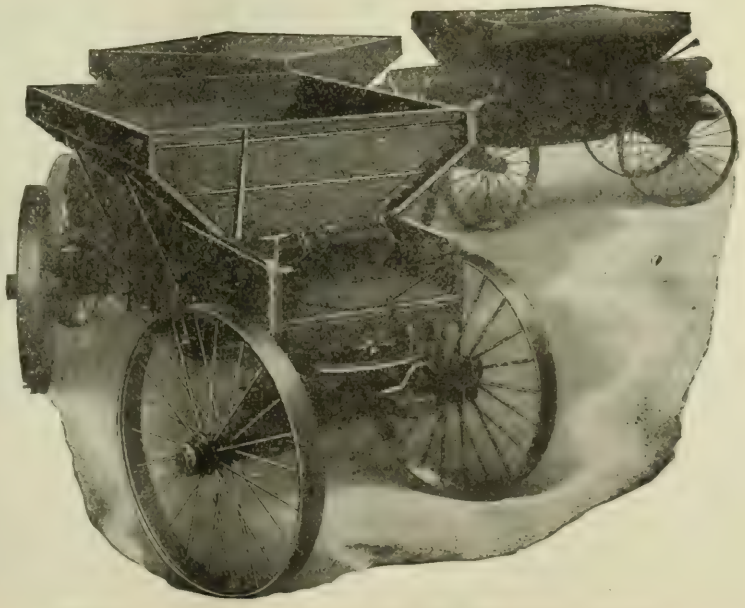
The heavy-duty tractor logging wagon, intended for use singly where trains are not advantageous, is made of steel and selected oak heavily ironed and has solid steel axles and adjustable length steel pipe reach 16 feet long. The weights are from 2,400 pounds for the 6-ton size to 7,500 pounds for the 20-ton size.

Eagle Glen Trailers

The Eagle Glen trailers, manufactured by the Eagle Wagon Works, successors to the Glen Wagon & Car Corporation, have been built for five years and have been constantly improved in accordance with the experience gained in trailer service in England, France and Germany which has enabled the builders to perfect a practical, well-built, flexible equipment that stands hard usage and gives satisfaction with little repairs.

The trailers are of both light and heavy construction, in numerous patterns for different kinds of service. The sizes include 1-ton, 2-ton, 3-ton and 5-ton chassis, the heavier ones being of 2-way reversible construction. They weigh from 1,020 to 4,000 pounds without platform or box.

There are also semi-trailers of 2, 4 and 6-ton capacity, that are made with skeleton platform or with a semi-dump box, the latter being adapted to speed of 8 to 10 miles per hour when loaded. The Model D 2-way bottom dump trailer is designed for handling crushed stone, earth, coal, sand or gravel and is provided with two bottom doors released by pulling a lever or kicking a trip. It has forged steel wheels with drawn steel hubs, similar to the wheels on Model S, which is constructed with inclined steel doors hung crosswise on the body of the trailer, which hoist upwards inside of the body underneath steel shields that protect them from the material carried. They are raised and lowered by worm gears operated by bevel gears and are controlled independently.



MODEL D, TWO-WAY EAGLE GLEN BOTTOM-DUMP TRAILER

They can be raised or lowered to dump the material in a layer from 3 to 14 inches deep.

Model L is a 5-ton logging trailer with reversible cross reaches turning all four wheels simultaneously. The steel wheels have double sets of dovetail spokes.

The Model A roller bearing steel trailer is intended to carry coal, sand or gravel and has a hard-wood box with bottom dump doors.

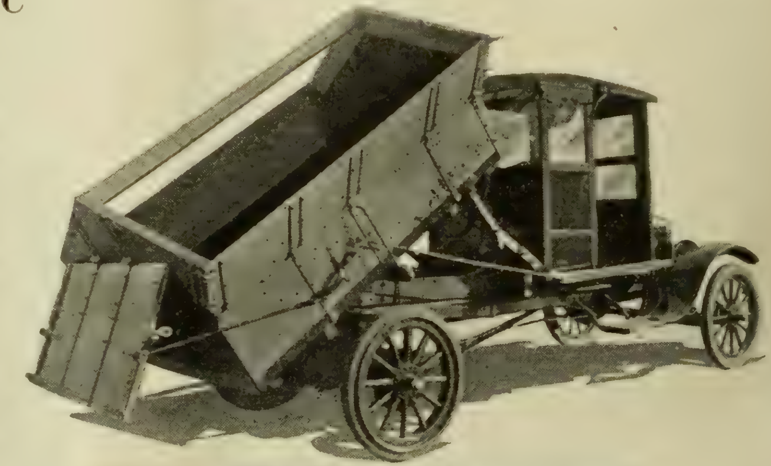
Various types of bodies, racks, stakes and sides are provided for different services. The No. 4 body, with 3-yard capacity, is divided into six pockets covered with removable apexes which, with the division boards, can be removed if necessary. Each pocket can be dumped separately through side doors hinged at the top and are very useful for highway repair work.

Jennings Automatic Dump Bodies

Patent truck bodies made by the Jennings Automatic Dump Body Co., Inc., are independent units applicable to any make of truck, to the sub-frame of which they are secured by four U-bolts. They are made of the best grade of oak, strongly ironed, and lined throughout with 20-gauge sheet steel. They are provided with an automatic tail gate, automatic lock and dumping lever that requires only 30 pounds pressure to handle a 2-ton load. The body is securely held in position by a spring catch which must be released before the load can be dumped.

When ordered, the bodies may be equipped with convertible tail gate, special operating devices or asbestos lining. They are manufactured in 1, 1½, 2 and 3-ton sizes, adapted for hauling building materials, crushed stone, cement, gravel and other materials.

The Jennings automatic dump body for hauling garbage, street cleaning refuse, and other materials of light specific gravity, has a capacity of 85 cubic feet and may be made from the standard 1-ton body by additional parts removed from it in a few minutes. The combination permits the body to be used for hauling light material or, with the additions removed, for hauling heavy material. It is constructed to allow the sides to be lowered for loading purposes and has a tail gate which may be operated automatically, providing a large opening so that the garbage can be dumped directly into the incinerator.



JENNINGS AUTOMATIC TAIL GATE AND HINGED SIDES

Steam Shovels

Thew Shovel Improvement

The Thew Shovel Company announces that it has practically revolutionized the whole procedure and product within the past two or three years, one of its chief objects being the standardization of the product and complete interchangeability of equipment and parts. The Type O shovel, the standard machine, has been adapted for much heavier work. The company's engineering department has worked out a combination of two types of trucks, the all-cast steel and the all-structural steel, the truck containing a heavy center casting reinforced and supported on one side by double I-beam structures. The whole frame is held together by through bolts and tie-rods, permitting tightening to be done in the field with an ordinary heavy wrench and replacements to be made at a minimum of expense. The makers believe that this type furnishes solidity and strength combined with the necessary resiliency.

The turn-table, which is mounted upon the truck and which carries all the mechanism and all the super-structure, is built up in a manner very similar to the truck. Mechanism for either steam, electric or gasoline operation can be applied and all are interchangeable.

The engines have been redesigned with increased bearing surface on wearing parts and slightly increased power in the case of the swinging and crowding engines. The main friction clutch, which operates the hoist drum, is now both released and engaged by means of a steam-operated ram instead of by hand. The turn-table has been so arranged that at any time the machine can be equipped for clam-shell, bucket, or crane service.

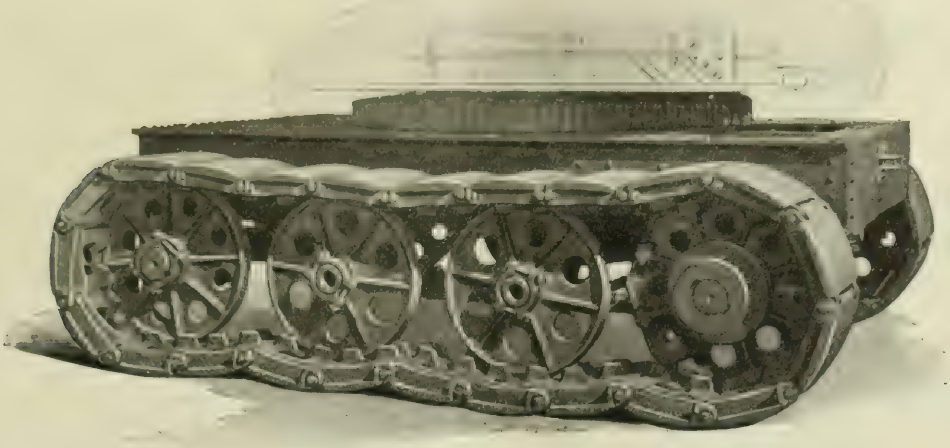
Another improvement is a new boom built in the form of a plate girder and so shaped that its center of gravity is nearer the base than in any other boom built, this giving a greater stability to the whole machine and therefore increased digging ability without increase in weight.

One of the most important minor features of the new design is the substituting of cut gears for cast steel gears in every instance except the large rotating gear upon the truck frame and the pinion which meshes with it.

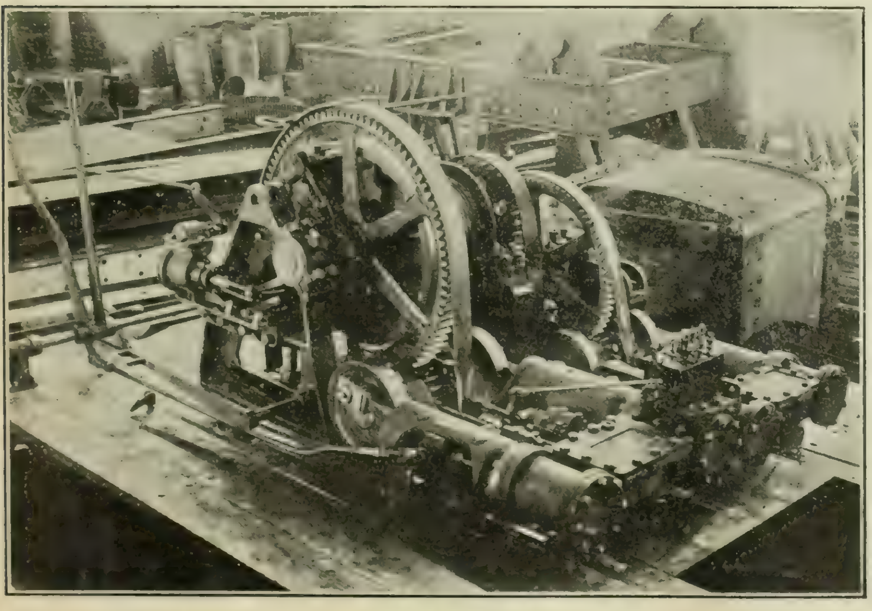
THEW SHOVEL, SHOWING PLATE GIRDER BOOM WITH SINGLE MEMBER DIPPER STICK; DOUBLE REDUCTION GEARS ON BOOM MECHANISM

Bucyrus 30-B Universal Shovel

This new steam shovel, manufactured by the Bucyrus Company, embodies new features designed to enable it to be used as a revolving shovel, a sewer shovel, a high-lift revolving shovel, a drag-line excavator, a clam-shell excavator, or a crane with the minimum additional parts. These features have been acquired without any sacrifice of power or without limiting the functions of machinery designed solely for either of the above purposes. The shipping weight varies from 5,300 to 6,000 pounds, according to the mounting for railroad, traction or caterpillar trucks.



BUCYRUS DIRECT GEARED CATERPILLAR TRACTION WITH CAST STEEL TREADS
(For other uses of the Bucyrus Shovel, see the first article in this issue)



LAYOUT OF THEW MECHANISM ON TURNTABLE
(Steam ram at left, engines at right. Shows cut gears)

Among the important features are the heavy truck frame, the dipper handle composed of two members straddling the boom with long racks that may be reversed to increase the wear, double cylinder reversing engine, machinery for operating different services without material change, swinging machinery mounted in front instead of rear, strong and simple propelling machinery, controlled by three conveniently arranged hand levers, a foot brake, a reverse lever and a propelling lever.

For drag-line operations the machine is equipped with a 1-yard bucket and 35-foot boom or a ¾-yard bucket and 40-foot boom, and with an additional drum, brake, clutch and thrust cylinder operating levers, boom, sheaves and bucket.

The same changes, with the exception of the additional drag-line trolley, high-speed propelling gears and heavy hook and block are provided, giving it a capacity of 9 tons at 20-foot radius.

The same additions, with the exception of a clam-shell bucket instead of a hook, transform the machine into a clam-shell excavator with a 1-yard bucket and 35-foot boom or ¾-yard bucket and 40-foot boom.

For sewer excavation there is required a ¾-yard dipper with 30-foot handle good for a 20-foot trench or a ¾-yard dipper with 24-foot handle good for a 14-foot trench.

Used as a high lift shovel there is required a long boom and long dipper handle with longer ropes.

This company is said to be the first to mount heavy excavating machinery on caterpillar traction, and recommends such traction for almost every condition. The 30-B may also be mounted on traction wheels or railroad trucks of any gauge from 5 feet to 3 feet 3 inches. The several mountings are readily interchangeable.

Conveyors and Loaders

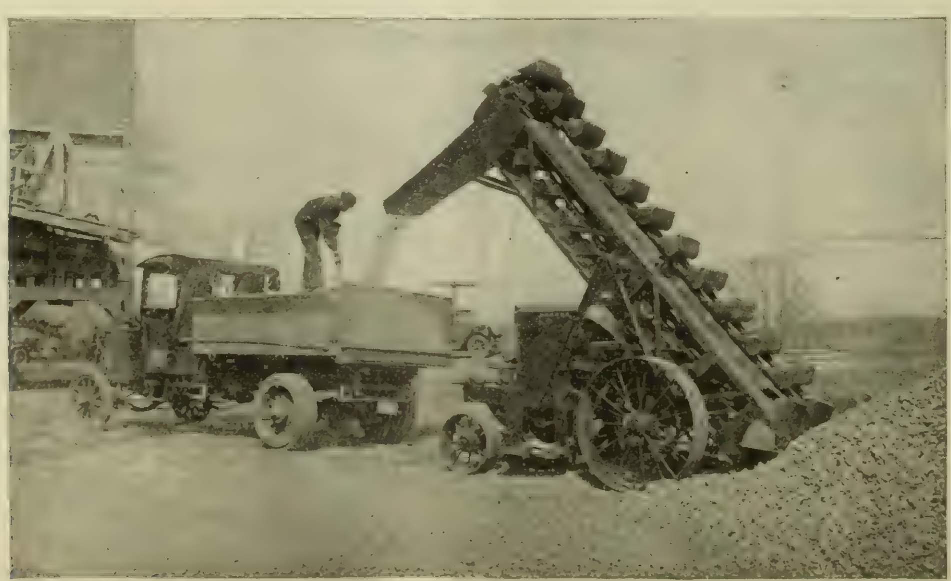
Haiss Wagon Loaders

Wagon loaders made by the George Haiss Mfg. Co., Inc., are used by road contractors, quarry companies, sand and gravel dealers and others for handling loose materials. They have an adjustable inclined framework mounted on a truck that carries the motor and driving mechanism. The lower end of the conveyor is equipped with a transverse shaft carrying propeller blades that dig and transfer the materials automatically to the elevator buckets. At the upper end of the conveyor there is an adjustable cantilever chute that delivers into the adjacent car, wagon or truck. With this machine 5-yard trucks can be loaded with crushed stone in 5 minutes at a cost of 2½ cents for power. The machine is driven by a 10-h. p. electric motor or gasoline engine.

The same company manufactures a similar wagon loader without the propeller blade digging shaft, that can be driven by a 5-h. p. motor. It also makes a bag-loading machine which can be driven by a motor operated by electric current, gasoline, kerosene or distillate.

A self-propelling machine owned by the Phoenix Land & Improvement Company, Paterson, N. J., was operated at the rate of 1 yard per minute at a cost of 1 cent for power. To do the same work by hand it would have required 5 or 6 men 25 or 30 minutes to load a 5 cubic yard truck with material.

Another machine used by the Union Building & Construction Company, Passaic, N. J., delivers and reclaims crushed stone to and from the storage reserve pile, thereby enabling the crusher to run continuously at the company's quarry. Sim-



PATH DIGGING WAGON LOADER, DIGGING 1 YARD PER MINUTE WITH ONE-MAN CREW ilar machines are being used for digging gravel and loading it into automobile trucks in the Panama Canal zone and some are now used for digging sand in the Ganges river in India, in Cuba, Japan and other foreign countries where labor is much cheaper than in the United States.

Mathews Gravity Carriers

For unloading cars or in paving, the carrier reduces cost of labor and reduces chipping. It eliminates the wages of four or five men in handling 35,000 to 40,000 bricks a day in street paving. The Mathews Gravity Conveyor Co. furnishes the following data of specific cases illustrating the special value their standard gravity roller conveyor.

Roehl Brothers, contractors, of Cleveland, O., write:

> We have long since wiped out the old practice of using wheelbarrows to place brick for the pavers, and we are using gravity carriers (Mathews type) exclusively. We would not think of going back to the wheelbarrows.
>
> In our operations we use two sections of carriers. By using four men to each section (two men placing bricks on the carriers and two men taking bricks off and placing them for the setter), it is no trouble to handle 40,000 bricks in an 8-hour day. If we were to handle the same amount of bricks by the old wheelbarrow method we would have to use four men in addition to the number required to operate with the carriers this necessitating twelve men where we now do the same amount of work with eight. As far as adroitness is concerned, we find it is impossible to do good work without skilled help. The men who are taking off the brick and setting them must be good brick handlers, which we consider skillful. The men who are putting the brick on the rollers must also be good brick handlers. We find it takes good men to do good work.
>
> It also can be noticed that the carriers have helped to reduce the number of culls, such as broken and chipped bricks, which always happens when dumping the brick from the wheelbarrows, thus saving a number of good bricks that would otherwise be culled out because they are chipped. The men also appreciate the carriers in the fact that setting brick with the carriers is less tiresome by far than the old wheelbarrow method.
>
> With the labor troubles that contractors are experiencing at the present time and without any relief in sight, a saving of four men is a big item, and with the very wide margin that the price of labor has, one can easily see if the price of labor keeps on advancing, the saving in the use of gravity carriers will keep increasing. Our data as to saving are shown below, figured on an 8-hour basis, in which we handled 40,000 bricks.

WITH MATHEWS GRAVITY CARRIERS

Two men putting bricks on rollers at $2.75 per day	$5.50	
Two men taking bricks off and setting at $3.00 per day	6.00	
	11.50	
Two sections		$23.00

WITH WHEELBARROWS

Nine men wheeling at $2.75 per day	$24.75
Three men setting bricks at $3.00 per day	9.00
Wheeling cost	$33.75
Carrier cost	23.00
Saving per day	$10.75

According to John R. Kennedy, of C. Kennedy & Son, Parkersburg, W. Va., this same gravity conveyor not only reduces the cost, but actually cuts down the percentage of chipped and broken bricks.

"We can handle bricks much more economically with the Mathews than was possible by the old wheelbarrow method," says Mr. Kennedy, "as it requires only about one-half the number of laborers. In using the wheelbarrows it was necessary to have two gangs, one wheeling and one setting up the bricks to the bricklayers. With the use of the Mathews carrier the wheelbarrow gang is eliminated and the brick is delivered to the layers in better condition, that is, not chipped or broken. With two good bricklayers and 10 or 12 laborers we can lay 50,000 bricks per day by handling the bricks over the Mathews carriers."

If the opinion of a large user is of any greater weight than that of any other experienced person, the testimony of the Stamey-Mackey Construction Co. should be important. This concern has been handling a large quantity of bricks with the gravity system, having in use eight or ten sec-

DELIVERING BRICKS FROM BOTH SIDES OF STREET TO PAVING GANG tions of Mathews gravity carriers. Said Mr. Stamey, in speaking of the efficiency methods he employed:

> Our carriers are all in the 8-ft length so that they will [illegible] various widths of streets.
>
> Unless the street is exceptionally wide, we use one set of conveyors to each man setting. We find that better time is made by having the brick setters divided up, using several gangs of this kind, than is made with more than one setter or layer to each conveyer. Of course, if the street is 40 feet or more in width, then we use two setters. For a narrower street where we are using two or three sections 8 feet long, we use one setter, two men taking bricks off the conveyor and setting them in place for the setter and two men taking them from the pile along the curb and putting them on the conveyor.
>
> A gang of this size will set 600 yards of 3-in. vertical-fiber bricks or about 20,000 bricks, in 8 hours. Before using the conveyors, we had 7 men with wheelbarrows for each setter. The chief disadvantages with wheelbarrows were in shipping bricks and displacing the ones already laid. If I were a brick manufacturer, I would insist that the contractors use these conveyors, as they save many a brick on a year's work.

A slightly different method of using the conveyors is carried out by Stipes & Pilcher, of Champaign, Ill. Writes Edw. S. Pilcher of that company:

> We do not handle bricks off the parking, but take them off the wagons instead and lay them directly in the street. We commence laying bricks at the end of a street or intersection and then place 2 x 12-inch boards for a track to run our loaded wagon on so as to bring them at all times up to the brick laying. In this way, we only handle our bricks once.
>
> On each side of the wagons we use a 16-ft. carrier and have two men putting the bricks on each carrier and two at the other end, stacking them for the brick setters. Our average is 35,000 bricks in a day, all of which are handled with the carrier, and it takes eight men to put them on and take them off. We are not compelled to handle the bricks so many times, and in muddy weather the bricks come to the setters clean and the men are not tracking mud in on the new bricks before the filler is poured. We always have the right number of bricks at hand where, if they are stacked on the parking, in some places you are a few short or have some left to pick up when the job is finished.

The Mathews gravity brick conveyors referred to by these contractors are all-steel ways provided with rollers over which the bricks are carried by their own weight to the setters. They are easily moved on casters, which are provided, and are built very strongly to stand the hard usage they are sure to encounter.

LOADING TRUCKS FROM CARS

Mathews gravity carriers have also proven economical in the loading of motor trucks from cars. In unloading cars it is customary to use three 4-foot sections and a 90-degree curve inside the car. If the packages are loaded direct into a truck, a connecting section either 4-foot or 8-foot long is necessary to run out into the truck. The principle is the same, however, for all purposes. When first starting to unload a car direct into truck, it is simply necessary to rest the first unit on the sill of the car. When an opening is created the 90-degree curve is added which may be pointed in either direction. As the work of unloading the car proceeds additional 4-foot units are added, as needed, until one end has been emptied. Then the three units are detached, the curve reversed, and operation repeated. When loading from truck into car the direction of travel is simply reversed and the same steps are followed. The full line is used to start with and gradually shortened up as the car is filled.

A paving contractor who has adopted the above method of car unloading explains his method as follows:

> When unloading cars of bricks into trucks, first place a standard 8-foot section of conveyor from edge of car door into truck, backed up to car at right angles. This will run the bricks up to the front end of the truck. As soon as an opening has been made a 90 degree curve should be attached to the car end of the 8-foot section. Then three 4-foot sections are added to the car, as needed, o keep the loading end near the bricks at all times. When one end of the car is empty, reverse the curve and repeat the operation. If common bricks are handled exclusively we recommend an 8-inch, which handles two bricks abreast. To obtain the best results the conveyor line should be filled from end to end and crosswise, so that when bricks put on at the loading end the same number must be taken off at the discharge end.

J. B. McAuley, Galesburg, Ill., contractor for sewers, pavements, brick masonry and general construction, writes:

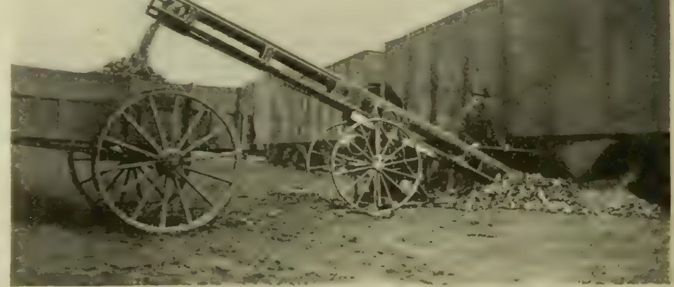
> We use the Mathews Gravity Carriers for unloading bricks from cars to wagons and we estimate a saving of about 15 per cent. over the method of carrying such brick or blocks with brick clamps; this does not include the saving in team time, which is reduced from 10 to 12 minutes to 7 or 8 minutes for loading each load.
>
> We also use the Mathews Carrier for conveying the bricks from piles along street to the brick setters; the carrier is mounted on swiveled caster supports, which can be moved in any direction promptly; with this machine this operation of transferring the brick or blocks from piles to brick setters, we estimate a saving of 20 per cent. of the labor cost, to say nothing of the saving of broken corners, etc., on bricks handled by the wheelbarrow method.

The Scoop Conveyor

The conveyors made by the Portable Machinery Company for loading and unloading sand, gravel, broken stone, coal and other materials are built in 14, 20 and 24-foot lengths, and in two widths, making six different sizes.

They have an adjustable inclined framework with an endless conveying belt perfectly balanced on a pair of wheels that support its electric driving mechanism. The distinctive feature is the scoop end that can be pushed or completely buried in the material to be conveyed, allowing the material to be scraped onto the carrying belt instead of shoveled into a feed hopper and thus saving about 50 per cent of the labor of feeding.

The belts are provided with low or high trans-



SCOOP CONVEYOR LOADING WAGON WITH BROKEN STONE FROM DUMP CAR verse cleats, according to whether the materials handled do or do not roll readily.

These machines can unload a car at any point along the track without requiring a pit or track hopper. With it one man can unload a 50-ton car in one hour under the most favorable conditions and in from two to three hours under ordinary conditions. Where the material has to be elevated higher than the reach of the machine, two or more machines can be set tandem, delivering from one to another and carrying the material to the required height without hand labor.

A 24-foot machine will load an open-top car with sides up to 11 feet in height. One man can load a 3-ton truck in a minimum of three minutes and an average of five to ten minutes. The carrying capacity of both the 12-inch and the 16-inch wide conveyors is 1 ton per minute. The belt speed is 140 to 180 feet per minute. Shaft bearings are selfaligning bronze filled with graphite. Any size conveyor can be transported on a 1½-ton truck. The total weight of a 12-inch by 20-foot machine with motor is about 1,100 pounds. They are equipped with either electric or gasoline engines.

The city of Highland Park, Michigan, writes that it has used the scoop conveyor for elevating sand, gravel and crushed stone at the rate of 1 yard per minute with two men shoveling. For unloading sand and stone from hopper-bottom cars, the cost was reduced 300 per cent.

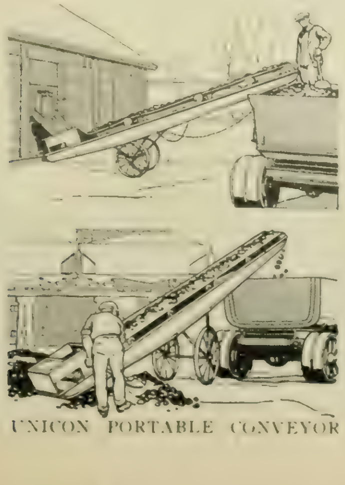
The Pendelton Mfg. Company, Autun, S. C., writes that in unloading coal from car to truck the conveyor saved half the cost of hand shoveling. Marcus S. Wright, So. River, N. J., dealer in sand and clay, "can load from 150 to 175 tons in a 9-hour day" with half the labor required for hand work.

Unicorn Portable Conveyer

The Unicon is a powerful, lightweight, self-contained, portable conveyor built by the Stephens-Adamson Mfg. Co. for handling bulk material at low cost per ton. This machine will handle sand, stone, gravel, coal, coke, ashes, brick, tile, bags and other materials for elevating and loading into trucks, buildings or other purposes.

The Unicon is manufactured in four standard lengths, namely, 15, 20, 25 and 30-foot centers, and is equipped with an 18-inch high-grade rubber conveyor belt. Each machine is furnished with an individual electric driving motor which is securely mounted within the steel plate girder type frame. When equipped with the S-A wire wheel truck and hoisting rig, the Unicon can be easily moved from place to place and the carrying angle can be quickly raised or lowered.

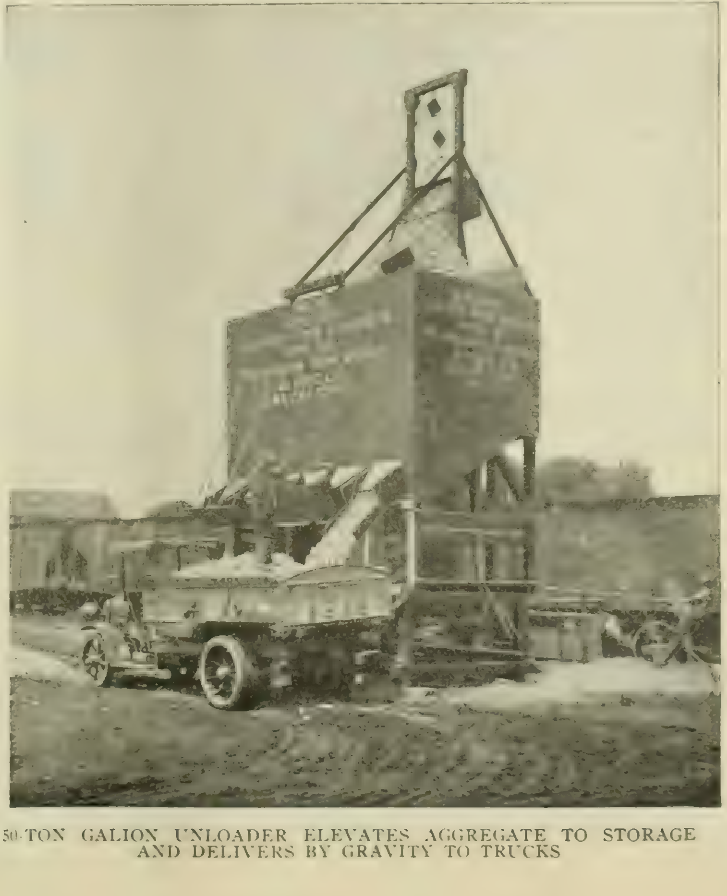
The manufacturers of this machine also supply safety car pullers of 7½ h. p. that develop a rope pulling capacity of 1,000 pounds at a speed of 30 feet per minute.


UNICON PORTABLE CONVEYOR

Galion Stone Unloader

The portable and stationary unloaders built by the Galion Iron Works & Mfg. Co. are of wood or steel, of 5 to 50 tons capacity. The machines are designed for unloading stone, sand, gravel and similar materials from a hopper-bottom car, carrying them to a bin and loading them into a truck or wagon without the employment of hand shovelers at any time. The essential parts of the machine are the frame, hoisting apparatus, bin, chute, pit, and power plant.

The unloader is first located at the siding, where the cars are spotted with the hoppers or slides over the depressed chute through which the materials are discharged into a bucket in a pit


50-TON GALION UNLOADER ELEVATES AGGREGATE TO STORAGE AND DELIVERS BY GRAVITY TO TRUCKS

between the unloader and the railroad track. The loaded bucket is hoisted up an inclined track to the top of a hopper bin, into which it is dumped. The contents of the bin are discharged by gravity into wagons, trucks, or cars alongside. To remove the unloader from one location to another, its inclined track is hoisted from the pit and folded; the tower is demounted and lowered; the side sections of the bin are lowered; trucks are placed under the bin frame, and the bin posts are raised on their hinges, permitting the unloader to be hauled away by trucks or road roller.

Steel unloader bins are made of 5, 15, 25 and 50-ton bin capacities. Wood unloaders are made of 18, 50 and 125-ton capacities. The unloader will handle from 500 to 600 tons of stone per day. A safety device is provided by which the opening under the track can be automatically closed as soon as the car is empty, thus conforming to the strictest railroad regulations.

An unloader used by the Hezlep-Seaton Company, Dayton, Ohio, handled material at a cost of not more than 3 cents per ton, effecting a saving of 15 cents per ton over hand methods. On a 6-mile concrete road job, one of these machines was estimated by T. P. Fitzgerald, contractor, to have saved $25 a day for 100 days.

The board of commissioners of Monroe county, Michigan, state that the unloader will pay for itself in "handling the material for two miles of stone road 10 feet wide and 9 inches thick."

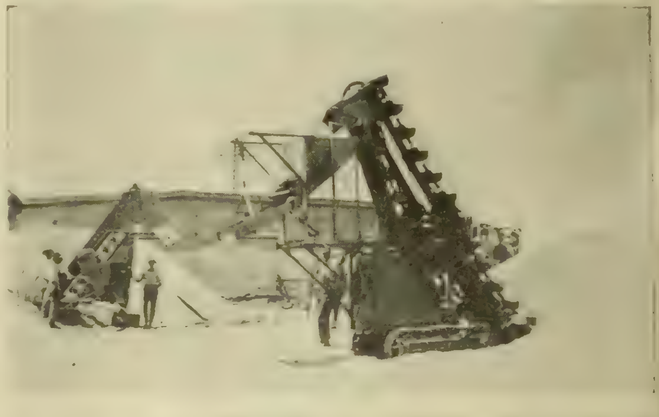
With one of these machines a boy employed by H. F. Ault & Son, Cardington, Ohio, unloads 3 cars, or 120 cubic yards of stone, for a cost of 2 cents per cubic yard for labor, gasoline and oil.

The Galion Imperial portable screening plant has a 4-compartment 20 or 30-ton wooden storage bin mounted on an elevated frame and equipped with a collapsible bucket elevator; an incline revolving, overhead screen, and four high discharge chutes. The mechanism is operated by a 6-h. p. enclosed gasoline engine. Under ordinary conditions the elevator will deliver 50 to 60 cubic yards of screened stone per hour. For transportation it is elevated and set on two pairs of wheels and can then be hauled by a team.

B-G Loaders and Conveyors

The B-G loaders and conveyors, manufactured by the Barber-Greene Co., for handling broken stone, gravel, coal and other materials are suitable for general contractors' use in many kinds of service. The loader consists of a steel bucket elevator slightly inclined from the vertical and mounted with its four-cylinder high-power Buda engine on a crawler type traction. It is provided with a platform from which the operator handles three levers, one for steering, one for the machine movements, and one for the bucket, besides a hand wheel to elevate and lower the horizontal discs at the foot of the elevator that keep the buckets constantly filled.

The buckets discharge into a spout that provides delivery at a height of 9 feet above the base of the machine. The most distinctive features of this machine are its sturdy construction, ample power, and especially the 36-inch steel discs that are driven by enclosed beveled gears and have excess capacity for cleanly picking up the loose material and feeding it continuously and automatically to the elevator buckets, thus dispensing with a large amount of hand work.



B. G. BUCKET LOADER WITH SELF-FEEDER AND CRAWLER TRACTOR

For General Construction

Koehring Concrete Machinery

Previous to 1919 the Koehring Machine Company had standardized the boom-and-bucket method of distributing concrete in highway construction; had developed the automatic releasing of the clutch and setting of the brake when the skip reached the proper elevation for discharging into the mixer drum; and had adopted the two-speed forward and one-speed reverse traction, allowing a speed of approximately 1½ miles per hour for travel across country. Since then it has adapted other improvements to its mixers.

WATER-MEASURING TANK AND BATCH METER

All its mixers now have the automatic water-measuring tank, insuring uniform consistency in all batches. The measuring feature of this tank consists of a pipe, the end of which can be raised or lowered. This movable end is in a tank of water which automatically fills to a fixed point and when the 3-way valve is opened discharges through this pipe, emptying the tank to the level of the adjustable end of the pipe. This end once being set, the same amount of water will be admitted to every batch.

In order to further standardize the mixing of concrete, the company developed the batch meter, which measures the amount of mixing received by each batch, locking the discharge of the mixer until the required time has elapsed and announcing the release of the discharge by the ringing of a bell. Experience shows that a mixer equipped with this instrument becomes a pace-maker for the crew and thus increases output.

NEW PAVERS

Two new pavers have been put on the market, No. 21E and 28E. These contain all improvements, such as the power discharge, caterpillar traction, a distributing bucket, which, opening crosswise of the road, spreads the material as the bucket is drawn toward the machine. All pavers except 28E may be equipped with a power-operated derrick for picking batch boxes from industrial cars or trucks and charging them into the skip. The derrick used on No. 21E consists of a mast moving vertically through rings on the frame and carrying a block for support at the base. A spring attached to the mast and to the top of the mixer frame holds it, when not in use, about 9 inches above the ground. The 10-foot boom swings freely. Power is obtained from a winding drum, both clutch and brake being controlled by a swing lever. When the cable picks up the batch box, the weight pulls the mast to solid bearing on the ground. The box is swung to position, emptied and swung back on to the car. As soon as the load of the box is released, the spring pulls the mast to its original position ready for the mixer to move ahead.

The larger machines have an automatic distributing bucket return so that, should the bucket strike the end of the boom, the clutch is instantly thrown out, the bucket dumps and returns to the mixer for another batch. The bucket may be stopped at any point on the boom by a level control.

The company has developed a No. 28E paver, the drum of which holds 28 cubic feet of concrete. Power is furnished for the drum by a 45 h. p. 4-cylinder gasoline engine. Instead of a charging skip, a batch hopper is useful, the boxes being picked up from the car or truck by a traction crane, elevated into position above the hopper, and dumped mechanically. Traction for the mixer is furnished by the crane.

MIXER LOADER

This company's mixer loader consists of a steel frame approximately 60 feet long, on which travels a belt conveyor for carrying the aggregate to the skip. This measures the materials exactly in the hoppers and charges the loading skip quickly as it reaches the ground.

The company also makes a contractors' pump for furnishing water for the mixer. This is a 4-cylinder pump equipped with a vertical boiler. It is a displacement ram pump, outside packed, and the steam governor is controlled automatically by water pressure in the line so that the pump operator has only the responsibility of firing the boiler.

Lakewood Equipment in Concrete Construction

The dam for the Connecticut Light & Power Company, at Stevenson, Conn., is 1,200 feet long and 122 feet high, and contains 160,000 cubic yards of conrete. This was placed at the rate of 30,000 yards per month, one of the best records being 750 yards in nine hours from two one-yard mixers.

The ends of the dam were built simultaneously. The river was then diverted through the power house gates and the central sections constructed.

A Lakewood concrete plant was selected for this work because it was guaranteed to handle 4-inch aggregate. Later the size of the aggregate was increased, and in order to be prepared, a large supply of extra repair parts were kept on hand but were not used.

Two mixing plants were installed, each containing two 28-foot electrically driven Lakewood-Milwaukee mixers, which delivered to buckets in duplex hoisting towers about midway between

KOEHRING MIXER LOADER CHARGING A KOEHRING MIXER the center and the ends of the work. The concrete for the center portion of the dam was spouted through three, and sometimes four, sections of type 0 unit plants and continuous 50-foot trussed chutes. The adjustable tower hoppers enabled the chutes to be located near the surface of the ground for concreting the foundations, and to be raised to higher elevations as the work advanced, thus eliminating unnecessary hoisting and expediting the distribution of the concrete, while always affording sufficient pitch to the chutes to enable the concrete to flow by gravity to the remote points.

A portion of the concrete was mixed in a gravity plant spouted to a re-elevating tower through eight 50-foot sections of Lakewood chute with elbow connections, making a 400-foot line of chutes. From the re-elevating tower the concrete was spouted to the forms. Each of the two plants installed consisted of two 28-foot electrically driven Lakewood-Milwaukee mixers. The tower and chuting plant used included Lakewood hoppers with sliding frames, tower sheaves, buckets, bin gates and about 1-3 mile of cable-supported chute and unit chute plants. Stones up to 12 x 8 x 6 inches and weighing 30 pounds, were safely handled through the chutes and the Lakewood elbow connections, the open inside construction of which offered no obstruction to the concrete at the junctions of the chute sections. The flat chute braces commonly used were, however, replaced by arched chute braces, enabling run-of-bank gravel to be used for aggregate and eliminating the elaborate elevating tower screening, conveying and storage plants that would otherwise have been necessary. The work was executed by the J. A. P. Crisfield Construction Co., Philadelphia, and C. W. Blakeslee & Sons, New Haven

Ransome Concrete Machinery

The Ransome Concrete Machinery Company manufactures practically all appliances used in concrete construction, including building, paving and pneumatic mixers and chuting equipment. Their latest small mixer is the improved Bantam No. 7-S. The most noticeable improvements made in this are as follows:

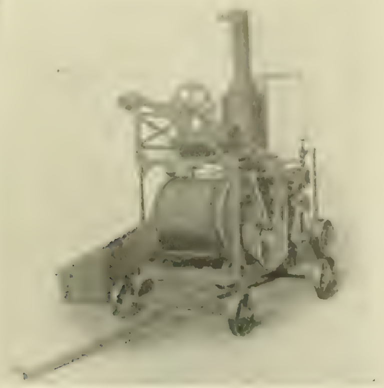
BANTAM MIXER

Front and rear wheels have the same tread instead of being narrower in front than in the rear; frame all steel instead of wood; width of rollers and traction rings increased from 1½ to 2 inches, diameter of rollers from 7 to 10 inches, and hubs from 4 to 8 inches; driving chain has 65 per cent more strength; a universal overhead frame has been adopted, making all charging mechanisms interchangeable. Motor power changed from 3 h. p. to 4 h. p. The compensating sheaves taking the cables from the power loader skip have been changed to grooved conical winding drums, giving a more positive action and saving wear on cables. All power loaders are equipped with an automatic knockout which throws on the brake when the skip reaches its highest position. Builders' hoists may be furnished on 7-S Bantams driven by gasoline engines, the hoist having a capacity of 750 pounds on a single line at 120 feet per minute, or, by using a double line, a hoist bucket with a full batch can be lifted 160 feet per minute. It is claimed that the driest mix is discharged rapidly from the drum, which is particularly advantageous in curb and gutter work where forms are

V DUMPAGE CARS AT UNITED DRUG COMPANY'S BUILDING, ST. LOUIS, BEING LOADED WITH SAND DELIVERED THROUGH LAKEWOOD BIN GATES removed as soon as the concrete has been discharged.

BUILDING MIXER

The standard building mixer, 1920 model, has axles built up of two 6-inch channels; front wheels 24 x 8 inches, rear wheels 36 x 8 inches; the large diameters and wide tires facilitating the handling of the mixers on difficult roads. The main frames are all channels, with six cross members and the rear half of the frame covered by a large steel squaring plate which stiffens the frame. All frames are standard built and will take steam, gasoline or electric power without any alteration. The mixing action of the 1920 model is exactly the same as that invented by the late E. L. Ransome, which he described as "a grinding, rubbing contact and forceable kneading of the materials into a homogeneous body." In the 1920 model, both sides of the drum pinion, which is of semi-steel, have been shrouded, increasing the strength almost 50 per cent and making it practically impossible to strip a tooth. The discharge mechanism has been completely redesigned and a splash plate provided to prevent slopping. The charging chute has a circular outlet the full diameter of the opening in the drum, permitting quick charging. The outlet into the drum is closed by means of a vertical sliding gate entirely outside of the hopper. The skip has the same general shape as before. The skip hoist drum clutch, sometimes called a hoist crab, is mounted on the countershaft instead of as a separate attachment on the side of the mixer frame as formerly and is of the contracting band type, self-locking and not requiring the operator to maintain pressure on the hoist lever during hoisting. In place of winding spools with a narrow, deep groove, the 1920 standard is equipped with a conical-shaped drum on which the rope winds into a separate groove for each turn, thus affording maximum power when the skip begins to lift and maximum speed as the materials slide into the drum. Water piping, instead of passing to the drum through the batch hopper and out through an opening in the gate, in the 1920 model runs between the side of the batch hopper and the mixing drum, keeping the piping entirely outside of the batch hopper and thus eliminating any interference by the water pipe with the materials passing from the hopper into the drum.



STANDARD BUILDING MIXER

These mixers are made in four sizes, known as the 4-S, 21-S, 28-S and 56-S. The two latter are furnished only on skids, the other two on either skids or trucks as desired. 28-S and 56-S are not furnished with gasoline motors but 14-S and 21-S may be equipped with steam, gasoline, electric or belt drive.

PNEUMATIC MIXER

Ransome-Canniff pneumatic concrete mixers and grout mixers are claimed to be practically the only type adapted to tunnel work and jobs where absolutely water-tight work is required. The grout mixer will average forty batches an hour, working against heads up to 175 feet. Cost sheets on tunnel lining work have shown that these mixers will mix and place concrete at approximately 40 per cent of the cost of mechanical mixing and placing by hand. It handles a batch of 14 cubic feet of loose aggregate or 10 cubic feet of mixed concrete. It will successfully convey one-half a mile, although shorter distances are the rule. Up to 500 feet it will average 50 batches an hour under ordinary conditions.

PNEUMATIC CONCRETE MIXER AND PLACER

PAVING MIXERS

The 1920 model of paving mixers, the 21-E paver, closely parallels the 1920 building mixer in design and construction. The power loader skip is extra light and can be used as either a closed or open-end skip. All mechanisms except the transmission are mounted on one shaft. The drum pinion has a jaw clutch, permitting the drum to be thrown out of gear on long travels. Either road wheels or crawling traction may be used, the latter of the type used on Marion steam shovels, extending the full length of the machine without break. Simple, leather-lined friction clutches, driven by chains direct from the countershaft, handle the bucket on the boom, making it particularly smooth running. The bucket is of the boom dumping type. This model can be very easily dismantled for railroad shipment and erected on the job, requiring only two men with wrenches. When ready for shipment its maximum height is 11 feet, thus clearing all standard bridges or tunnels.

CHUTING EQUIPMENT

The Ransome chuting plants include both a boom plant, either stationary or portable, and a continuous line plant. The 1920 hopper heads have been increased 25 per cent in depth to take care of the checking of the return of flow caused by the change of direction at the hopper head, which would otherwise permit the concrete to pile up until the original velocity was again acquired. The chutes are standardized and completely interchangeable, and built on a system of unit construction. The steel towers are built in 15-foot lengths, which has been found most economical for shipping, assembling and dismantling.

PORTABLE WOOD WORKING MILLS

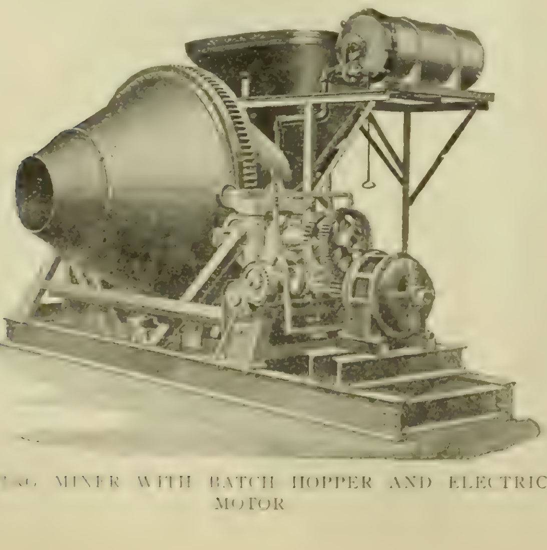
This firm also makes a portable wood-working mill, built all of steel. Three and 6 h. p., type Z Fairbanks-Morse engines are used, fitted with Bosch magnetos, designed for use of kerosene. When desired, 3 h. p. or 5 h. p. electric motors are furnished; or the mill may be driven from a line shaft or an independent motor. Fourteen-inch rip and crosscut saws are regularly furnished with the 3 h. p. outfits and 16-inch with the 6 h. p. gasoline or 5 h. p. motor outfits. Each outfit includes ripping gauges, crosscut gauges, a 6¼-inch jointer for planing, a boring attachment and a 10-inch disc sander. In addition an emery wheel, mortising attachment, molding attachment, band saw attachment, dado head, jig saw, and wood lathe attachment may be used.

Smith Pumps, Excavator and Concrete Mixer

MIXERS

The Smith non-tilting mixer is made with capacity for 4, 7, 14, 21 and 28 cubic feet of mixed material. Sizes above 4-S can be furnished on trucks or on steel skids, and can be equipped with power loader, batch hopper or standard with either steam, gasoline or electric power. Smith patented central drum ring increases the life of the mixer by insuring even wear on the rollers, bearings and roller tracks, and their center location prevents them from coming in contact with falling dirt and concrete.

The 4-S mixer, non-tilting type, handles 4 cubic feet of wet or 6 cubic feet of loose material. Can be equipped with gasoline or electric power and with power loader, batch hopper or with a low charging platform only 18 inches from ground. Entire capacity of the drum discharged in 8 seconds.



THE 4-S MIXER WITH BATCH HOPPER AND ELECTRIC MOTOR

The tilting mixer discharges the entire contents of the drum at one time by tilting the drum while it is revolving. Made with capacity for 10, 14, 21, 28 and 56 cubic feet of mixed material. On steel skids or on trucks. Can be loaded by either standard feed spout, gated batch hopper or power loader. Power furnished by either gas engine, electric motor or steam engine. Easily the fastest discharging type of mixer ever designed.

Smith Simplex paving mixers are made in three sizes having capacities of 10, 14 and 21 cubic feet of mixed material. Interchangeable with boom-and-bucket or chute delivery. Traction is interchangeable with either the wheel or caterpillar type. Either of these changes can be made quickly and easily—right on the job if necessary. High drum design gives the boom a clearance of 7 feet from the ground, permitting workmen to pass below it and making possible a deep narrow bucket which will handle even the dryest mixtures without overloading. Gasoline or steam power. Holds world's records for production.

PUMPS

Smith high-pressure force pumps are made in sizes ranging in capacity from 700 to 3,500 gallons per hour and in two types, the double-action force and the outside packed plunger. Cylinder is cast integral with jack bearings, insuring perfect alignment at all times. On skids or on trucks.

Smith centrifugal pumps have capacities ranging from 7,200 to 28,500 gallons per hour. Every part of the pump is built to jig and limit gauge. Repair parts are quickly installed, with perfect assurance of an absolute fit.

Smith diaphragm pumps are made in capacities of from 4,000 to 19,000 gallons per hour. Three styles—single diaphragm "anti-splash," double diaphragm "anti-splash," and "odorless" single diaphragm. "Odorless" pump will operate against a friction head of up to 30 feet and is completely inclosed so that the odor from materials being pumped is retained within the pump. Mounted on steel skids or trucks.

EXCAVATOR AND LOADER

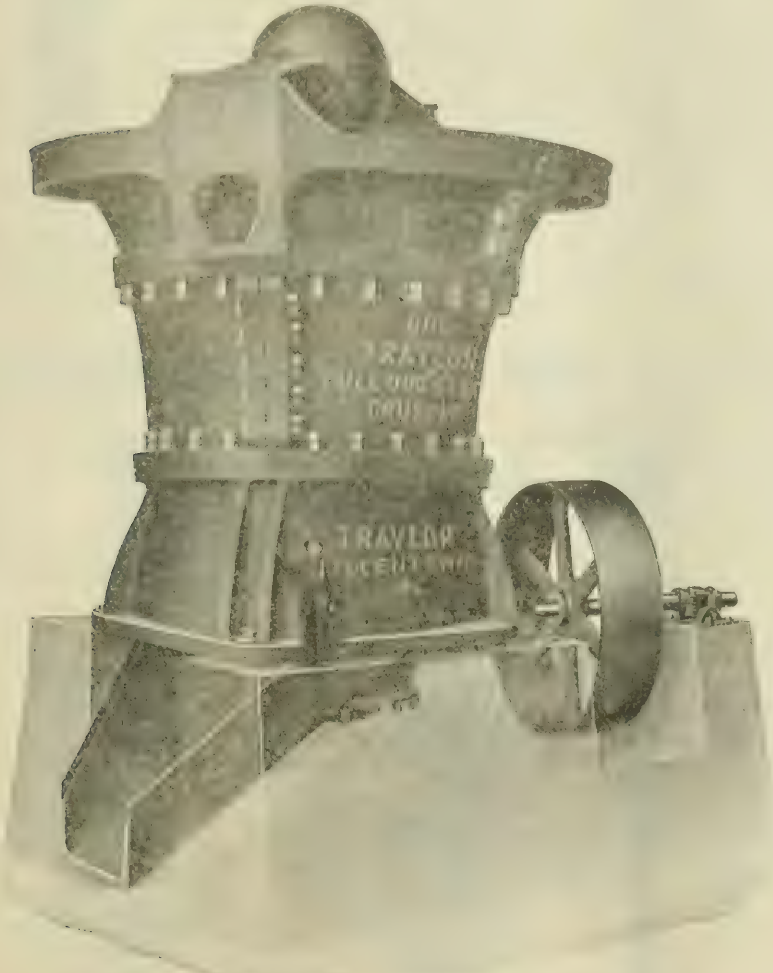
The Smith excavator and loader is a portable drag-line which both digs and loads. The digging slip operates on a cable drawing the material up to the machine. It is then lifted up over the machine and emptied into the awaiting trucks or wagons. Requires but two men to operate and has a capacity of from 150 to 350 cubic yards of material per 8-hour day. Excavates within radius of 200 feet of machine. Machine itself works at loading level; does not get into the excavation; is easily moved from one job to another.

The Easy Double Claw Bar

This tool, made by the Easy Mfg. Company and sold by hardware dealers generally, is 27 inches long, weighs 4 pounds, and is very efficient for general wrecking work. At one end it is slightly bent and flattened to a chisel edge for use as a punch bar. At the other end there is an oblique T head with double claw so that it can be either pushed or pulled and will reach work not accessible by an ordinary claw. It will hold a nail without a head, will pry off boards without splitting them and is a very handy wire stretcher and fence tool.

The Largest Stone Crusher

The Traylor Engineering & Mfg. Company claims the distinction of having built and erected the largest stone crusher in the world, an enormous machine about 25 feet high from foundation to top. It weighs over 800,000 pounds and was completed in ninety working days, the erection requiring only fourteen days from freight car to breaking stone. This machine was installed more than a year ago at the largest limestone quarry in Michigan in order to eliminate labor in handling stone and thus cut down the amount of block holing and quarry work. It has a capacity for receiving rocks with dimensions of 5 feet in any direction, some of which weigh as much as 15 tons each. These are broken to 8-inch size at the rate of more than 40,000 tons per 20-hour day, which has been averaged since the machine was installed.



GYRATORY CRUSHER WITH CAPACITY FOR 40,000 TONS PER DAY OF 5-FOOT ROCKS

This machine is of the standard bulldog gyratory type, and in order to limit the bearing pressure to safe amounts, it has an eccentric more than 8 feet long and 45 inches in diameter, with 9,900 square inches of bearing surface, fitted with a self-aligning journal bearing that absolutely prevents binding and reduces the friction.

It is lubricated by a fully submerged gear type pump which provides circulation for the continual bath of oil in which all the moving parts, including the cut steel gears, run. The main shaft is shorter and very much stronger than in other makes of gyratory crushers, resulting in a high percentage of power efficiency and smaller amount of power consumption per ton of material crushed.

The builders of the bulldog gyratory crushers also manufacture a complete line of "Bulldog" jaw crushers, crushing rolls, revolving screens, rod, ball and tube mills, stone elevators and other quarry, mine and smelting equipment.

"Ever-Clean Gravel Screen"

The Ever-Clean gravel screen made by the Beach Mfg. Co. is especially recommended as being constantly and automatically maintained clean, thus preventing clogging with wet material and fine pebbles that greatly reduce the capacity of a sand screen. It is also adjustable to permit the grading of the gravel, from which any required percentage of sand may be removed.

A light collapsible steel framework supports the inclined flat screen which operates like an endless belt, and is composed of short transverse sections pivoted at their upper edges to a pair of sprocket chains so that as they reverse at the upper end of the incline they strike a spring buffer and are cleaned, returning on the under side of the incline, hanging vertically until they reach the lower end when they reverse and form a continuous overlapping series moving upwards to the top and so on, traveling against the flow of sand and gravel which descends by gravity in a layer never more than ½ inch thick as compared with the 8 or 10-inch depth in a rotary screen.

The unscreened gravel is elevated in the 8 x 10-inch buckets over an inclined conveyor which discharges into a perforated revolving cylinder which rejects the oversize stones and delivers the remainder to the inclined screen.

The screen, cylinder and conveyor are operated by an 8-h. p. gas or kerosene engine enclosed in a steel-lined room under the storage bin.

In service, the screening apparatus is mounted on top of the storage bin but can be collapsed and lowered, and the storage bin is mounted on trucks or wheels for its easy transfer to another site, which can be accomplished and the apparatus set up ready for operation in 20 minutes, thus making it easy and economical to keep the screen close to the bank.

Sullivan Drills

Sullivan Rotator drills, manufactured by the Sullivan Machinery Company, are an improved type of hammer machine used for a large variety of rock work, such as block holing, cutting ditches, shaft sinking, drifting, stoping, light tunneling, quarry work, road grading, trench and open ditch work and down-hole drilling.

The Rotator is a one-man drill, weighing 29 to 40 pounds, drilling holes from 8 to 12 feet deep for 1¼-inch powder, and may be used as a hand tool or on a mounting.

It is made in seven separate classes, viz., hollow piston Rotator, solid piston Rotator, air tube Rotator, water tube Rotator, steam tube Rotator, auger Rotator and light Rotator, all of which may be used with cradle and feed screw mounting or with pneumatic air feed.

The steam tube Rotator is similar to the air tube drill but uses steam instead of air.

The drills have automatic lubrication, the oil being distributed as a spray over the working parts. The handle is arranged with either a double grip for hand feeding, or with a single grip when mounted.

The new auger Rotator, class DR-37, has been developed for drilling in soft, broken or loose ground where the ordinary compressed-air hammer drill strikes too hard a blow. It weighs 35½ pounds and is only 18 inches long.

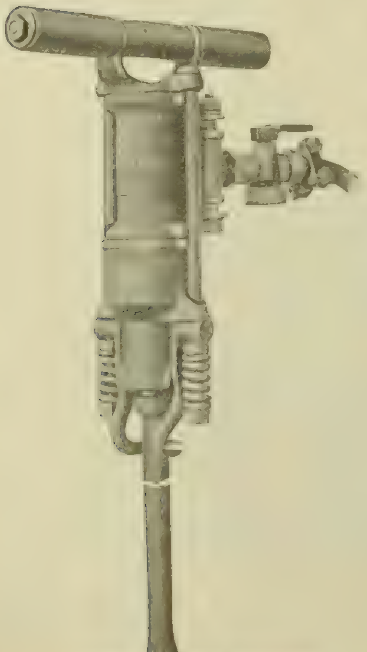
The new light-weight Rotator, DP-32, is designed especially for work in which it is customary to hold the drill by hand, even when above the horizontal. It has a high drilling speed, excellent running balance and very little vibration. It uses ⅞-inch hollow hexagon steel and will drill 4-foot holes under average conditions.

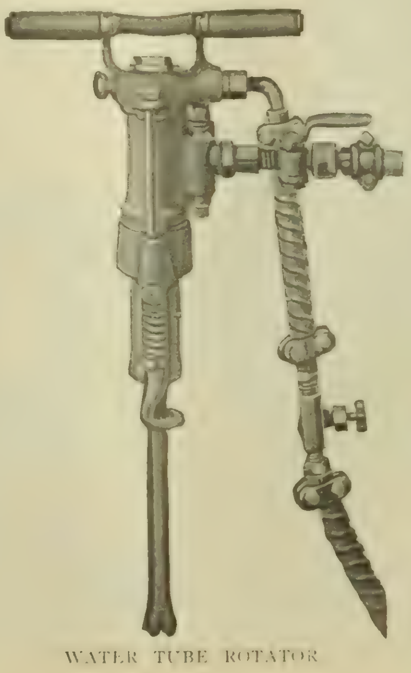
DH—3 PLUG DRILL

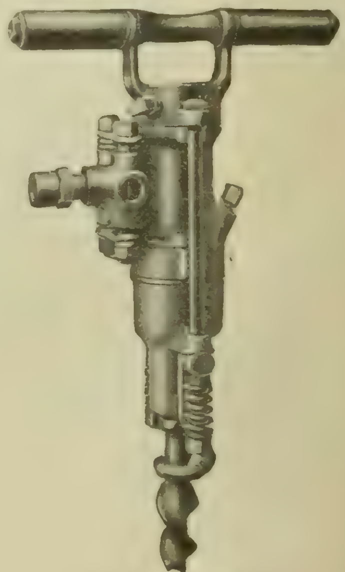
Another new Sullivan hammer drill is the plug drill, DH-3. This is recommended especially for granite drilling. Speed, light weight, reduced vibration and small air consumption and repairs are among the advantages claimed for it. It is 18 inches long, weighs 20 pounds, uses 7-16-inch air hose, is rotated by hand and the holes are cleaned by a blower hose.

The efficiencies of these machines are demonstrated by letters from users, who report some notable records. Repairs were at the rate of $0.015 per lineal foot drilled for Rotators working in hard rock at the Utah Silver-Lead Mines.

One DP-33 water drill on cradle mounting drove 175 feet of 5 x 7-foot heading in very hard diorite for Sullivan, McQuarrie & Clark, contractors, on the So. Pacific Gold & Copper


DP-32 LIGHT ROTATOR


WATER TUBE ROTATOR


DR—37 AUGER DRILL

Co.'s adit, north of Ogden, Utah, without being taken out of the heading during the entire distance and was never taken apart.

At a well known Arizona copper mine, Rotators have cost $6.53 per quarter year per drill for repairs, based on 67,000 drill days of use. Based on 6,000 drill days during the last quarter, the cost has been $1.28 per drill.

Sullivan Diamond drills for taking test cores have a capacity of 300 to 7,000 feet and are available for operation by hand, horsepower, belt, compressed air, steam, electricity, gasoline or oil engines. They secure cores of 15-16 to 2 inches diameter from any kind of rock formation.

For the preliminary exploration of the site of the dam at Widow's Bar on the Tennessee River, 47 test holes in water 6 to 8 feet deep were drilled to a depth of 18 feet in the solid limestone by a Sullivan Bravo drill operated by a gasoline engine and removing core 15-16 inches in diameter that demonstrated the soundness of the rock.

Blasting Appliances

The Davis No. 1 blaster, manufactured by the Atlas Powder Company, weighs 3¼ pounds and develops ample current to fire five 30-foot copper wire electric blasting caps, or five 6-foot iron wire electric blasting caps, connected in single series. The outer case is a seamless brass tube, heavily nickeled, the top and bottom plates are aluminum. It has binding posts to which the leading wires are connected. To fire the blast the machine is held in the left hand; the key, held in the right hand, is inserted in the bottom slot and given a hard turn to the right.

NO. 1 BLASTER

CARRYING CASE CLOSED

CARRYING CASE OPENED

The Atlas moisture-proof blasting cap carrying case is the only device of the kind which makes suitable provision for a day's supply of blasting caps. It is made of aluminum, is ⅞ inch in diameter and 2⅛ inches long, holding seven No. 6 or 8 blasting caps. It has a telescopic lid protected by a rubber sleeve covering the joint and making it moisture-proof. It is easily carried in the pocket, insures the proper condition of the caps and prevents any danger in handling them. The carrying case and the Davis blaster are both handled by the Atlas Powder Company.

Williams' "Falcon" Chain Wrench

The single jaw and interchangeable flat link or cable chain wrenches for holding pipe and fittings of from ⅛-inch to 12-inch diameter are put on the market by J. H. Williams & Co. They are new tools valuable for pipe work on many kinds of construction operations or in machine or repair shops. The removable jaw is reversible, end for end, so that all of the teeth may be equally worn, after which they may be file sharpened. All parts are interchangeable and replacements are carried in stock. The wrenches are from 20 to 64½ inches long, weighing from 5¾ to 50 pounds each. The flat link chains have breaking strengths of 6,700 to 21,800 pounds.

A New "Jackhamer"

Another Jackhamer known as the DCR-13 has just been brought out by the Ingersoll-Rand Company. This completes the family of Jackhamers manufactured by this company. The others are the BAR-33, 21 lb.; the BBR-13, 36 lb.; the BCR-340, 41 lb., and the DDR-13, 70 lb. Altogether there are five sizes and thirteen types. This company now claims to have a Jackhamer available for every hand-hammer rock drilling job.

The new Jackhamer weighs 55 lb. It is rated to drill holes up to 12 feet deep rapidly in hard rock and it will fill all the requirements of a medium-weight sinker or down-hole drill. Hence it will be welcomed for shaft sinking, quarrying, road building, prospecting, developing, etc. It is extremely simple and sturdy, so it will easily withstand the most severe uses encountered in the class of work for which it is designed.

The features most worthy of note are: All-steel construction, steel drop forgings or bar stock being used exclusively and specially heat treated. All bolted construction, nothing to work loose and easy of access. Automatic rotation, very powerful, relieving the operator of this fatiguing part of the work. Spring-retained fronthead, takes up shocks that would otherwise fall on the machine. Spool butterfly valve, operating on the well known "butterfly" principle. Handy hole-blowing device, very effective in keeping the drill hole clear. Renewable bushing in rotation sleeve. Automatic heartbeat oiler and grease pockets in handle and front head assure continuous satisfactory lubrication.

These drills are furnished for drilling dry holes (DCR-13) and wet holes (DCR W-13). Although they are usually used unmounted as sinkers, they may also be supplied with the JC-11 mounting for development or light drifting work.

Yale Chain Hoists

The line of hoists manufactured and sold by the Yale & Town Company provides a portable, spur-geared, screw-geared, or differential-chain block and electric hoist for almost every purpose requiring a light, easily handled and operated device for lifting weights to a moderate height. When operated by a single man exercising an 80-pound pull on the hand chain, these three types respectively hoist an 800-pound, a 1,700-pound, or a 2,000-pound weight 18 inches, 12 inches or 24 inches in ½ minute, using a 1-ton differential, screw-gear, or spur-gear block.

The spur-geared chain block is so constructed, and the pressure of the gears is so balanced, that the load is distributed equally on every tooth of every gear and on both bearings, reducing wear to a minimum. It is the safest and speediest portable hand hoist where loads must be lifted frequently by expensive labor. It holds the load and will not lower it until the hand chain is pulled. It is made in 17 sizes with capacities of 500 pounds to 40 tons.

The Yale differential chain block is adapted to occasional services for comparatively light loads and requires a hand chain pull 2½ times as great as that for the spur-geared block. It has the fewest parts and great reliability and simplicity. It is made in six sizes with capacities of 500 pounds to 6,000 pounds.

Yale electric wire rope hoists are in a class midway between chain blocks and heavy-duty traveling crane and give from 5 to 10 times the speed of hand hoists. They are made with capacities of 1, 2, 4, 5, 6 and 10 tons for use with direct or alternating current.

The same company also produces electrically operated chain hoists which can be safely used with unskilled labor at a speed from 5 to 10 times as great as that of hand hoists for loads of 50 to 4,000 pounds.

The steel chains used in these machines are die forged for maximum accuracy and durability, and are electrically welded on the side, securing a joint that is claimed to have 100 per cent strength so that a ½-inch Yale steel chain has an ultimate strength of more than 22,000 pounds. The chains are equipped with steel safety hooks so designed that with heavy overloads they will open slowly without fracture.

Gasoline Driven Diaphragm Pumps

The gasoline driven diaphragm pump outfits made by the Edson Mfg. Company are adapted for use on sewer and construction work. The pumps are driven by air cooled gasoline engines which are competent to exert a force of 1,000 pounds per stroke and are guaranteed to drive the No. 3 (3-inch) diaphragm pump at full capacity for a fuel cost of 2 to 5 cents per hour. The outfit can be easily transported by two men. All the gears are enclosed in the crank case and run in oil. The weight of the engine and pump mounted on skids is 390 pounds; mounted on trucks, 565 pounds.

Aeroil Kerosene Burners

The Aeroil kerosene burners, made by the Aeroil Burner Company, are recommended to produce smokeless fires for melting tar, pitch, asphalt, varnish and rock asphalt mastic. They do not produce sparks, smoke or ashes and are adapted for outdoor use, where the flame cannot be extinguished by wind, rain or snow.

They are constructed for rough usage and, being free from delicate or complicated parts, will last a lifetime. Economy of time and labor is ef-

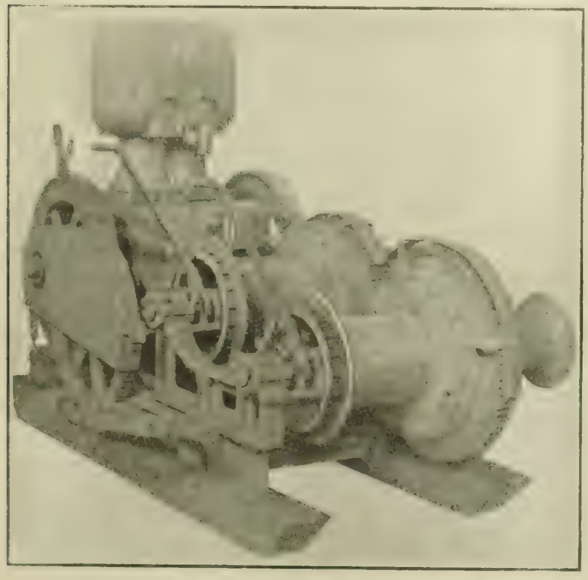
AEROIL BURNER ATTACHED TO A WHEELED KETTLE fected by the use of coal oil, which eliminates the trouble and delay of cutting and hauling wood for fuel. They are made in three sizes with capacities to melt 1 barrel of asphalt in 40 minutes, 2 barrels of asphalt in 50 minutes or 3 barrels of asphalt in 70 minutes. The No. 3 burner melts and cooks 1,200 pounds of rock asphalt mastic in 2½ hours, using 8 gallons of kerosene.

Novo Air Compressors Pumps and Hoists

The portable air compressor manufactured by the Novo Engine Company is a 6x6 inch duplex machine with piston displacement of 80 cubic feet of free air per minute at 100 pounds pressure. It is operated by a 15 h. p. Novo gasoline engine which may be mounted with it on a truck, keeping the center of gravity at a low elevation and enabling the operator to start the engine from the ground. The engine and compressor are connected by a special friction clutch coupling that permits the engine to start without load and have the compressor thrown on after full speed has been attained. The compressors are suited to operate stone cutting tools, rock drills, paint sprayers, concrete surfacing tools, caulking tools, wood or metal boring machines and pneumatic riveters.

The Novo DH hoist is a very compact and durable machine built with ample factors of safety, strength and durability for constant hard usage. It is designed to be controlled from positions where the operator commands a full view of the hoist and load and is fitted with powerful brakes to assure the greatest safety in hoisting and maintaining the load.

It has a capacity for hoisting 3,000 pounds 120 feet per minute or 1,400 pounds 280 feet per minute and can be made reversible or single speed as desired.



TWO-DRUM HOISTING ENGINE ON SKIDS

PORTABLE AIR COMPRESSOR, GASOLINE ENGINE AND RECEIVER

The smaller type T hoist can be mounted on steel trucks for portable work and is made with a two-speed sheave, which can be operated entirely independent of the drum if desired. It is made in 6, 8 and 10-h. p. sizes, geared either 9-1 or 12-1, as required. These different sizes and gears give it a range of from 1,000 pounds hoisted 150 feet per minute to 2,800 pounds hoisted 100 feet per minute, thus affording considerable range and variety for light work.

The Novo Company also manufactures a duplex pump operated by the Novo engine and mounted with it on a rigid base that is capable of delivering water through several miles of pipe line. The 6-h. p. size will deliver 14,000 gallons per day and the 10-h. p. size will deliver 18,000 gallons per day.

The same company also manufactures portable diaphragm pumps and centrifugal pumps driven by their standard engines and having capacities for raising up to 12,000 gallons per hour for low heads.

"Dumps Right" Cars

The "Dumps Right" cars, manufactured by the Automatic Dump Car Company, have an all-metal body, cut-steel gears, bronze and steel bearings, pressed steel frames, and are made in sizes of 1½, 2 and 3 yards, weighing, respectively, 1,400, 1,550 and 1,650 pounds.

The dump body is made of 11-gauge, hot-rolled steel with smooth welded seams, and glides easily to side dumping position without cables or chains, being actuated by positive members that are entirely reliable and will dump the load with ease and accuracy two feet away from the truck wheels and return to original position in 1½ minutes.

The body is perfectly smooth inside, enabling it to be washed clean with a hose. Hot asphaltum will discharge as easily and leave the body as clean as will dry, clean sand.

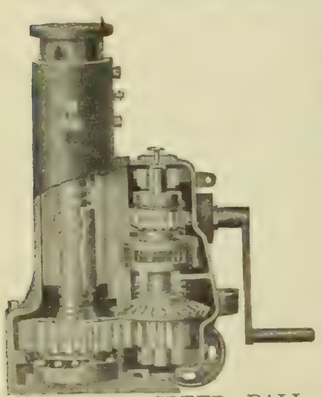
Trucks equipped with these dump bodies have considerable advantage in being able to deposit the load without turning around or backing, as is required for end dumps. They are used by the

Gross Nickle Construction Company for hauling asphaltum, which is dumped on the side of the street without the trucks running over the new or unfinished pavement, which might damage the base; a fact which is considered of importance by the above contractors, who also state that the dumping is done easily and more quickly than that of many other dump trucks they have seen.

A New High-Speed Ball-Bearing Screw Jack

Many novel features of construction are embodied in the latest design of Duff high-speed ball-bearing screw jack, a tool which is particularly adapted for bridge work and other purposes where a lifting capacity of 50 and 75 tons is required.

The most noticeable thing that distinguishes it from previous designs of screw jacks is the fact that the operating mechanism, instead of being located in the head, is placed in the base. The greater weight is thus put at the bottom instead of at the top, so that the jack is not top-heavy. Another advantage is that the point at which the operating level is pivoted does not rise with the load. This allows a full, powerful stroke, regardless of the height of the load.



DUFF HIGH-SPEED BALL-BEARING SCREW JACK

This newly designed jack is unusually easy to move about. Not only does the concentration of weight in the base make it easy to handle, but by inserting the operating lever in special sockets, the jack can be tipped over by one man and rolled on its own sturdy wheels wherever needed.

The load is raised by means of a 6-foot steel lever which operates a double-thread screw through a ratchet and gearing. The screw has a very steep pitch, making the action extremely rapid. The screw is made of special machinery steel, heat treated, and turns in a bronze nut of special composition. This combination of bronze and hard steel materially reduces friction.

Absolute safety is assured by a positive clutch which holds the load at all times, preventing any possibility of it sinking or lowering. The fact that the holding clutch does not permit any appreciable sink-back assists in making every ounce of pressure applied to the elevating lever count. Another safety feature is the signal which is provided to indicate when the jack has reached its maximum height.

For lowering, a crank handle is used. A few easy turns are all that are required, as the action is very rapid. Regardless of the speed with which the load may be descending, it may be stopped with absolute safety at any point desired. The action is positive, so there is no possibility of sticking.

This jack is made by the Duff Manufacturing Co. in two capacities, 50 and 75 tons maximum. Both the 50 and the 75-ton jacks are supplied in a variety of heights to suit any requirements.

Red Edge Shovels

The Wyoming Shovel Works issue a number of pamphlets descriptive of "Red Edge" shovels, scoops and spades, emphasizing the importance of correct design. One of these booklets, called "Scientific Shoveling," contains an excerpt of Frederick W. Taylor's book on "The Principles of Scientific Management." Mr. Taylor conducted a test at the plant of the Bethlehem Steel Company and found that a man could do his biggest day's work with a shovel load averaging 21 lb. As the result of proper training and correctly designed shovels, the cost of handling was decreased from $.072 per ton to $.033.

This pamphlet also contains some practical rules in shoveling, some of which are as follows:

1. The loads should never be thrown more than 12 feet horizontally and 8 feet vertically with long handle shovels, nor more than 10 feet horizontally and 6 feet vertically with short handle shovels.
2. Men should never carry shovel loads. The shovels should be used only for digging, casting or spreading. One step should be the limit while shoveling.
3. The men should be kept in small gangs but never worked alone. Two men together will shovel twice as much as two men working alone.
4. Long handle shovels are best for casting and loading, short handle shovels are best for unloading or digging where the stroke is downards.
5. It is important to select the proper pattern of shovels.
6. In digging into a stock pile where material is not more than 36 inches high, a man will average 20 shovel loads per minute; if casting earth not more than 10 feet he will average 18.
7. Shoveling into a wheelbarrow or low cart reduces the average to 13, and each 6 inches additional height of car reduces the average 2 per minute. About the same ratio exists for horizontal distances.

Wyoming Red Edge shovels are made of chrome nickel alloy steel, rolled in the company's own rolling mill. The blades are heat treated throughout, making them as hard as tool steel and as tough as spring steel. To these blades are attached handles of selected XX second-growth northern white ash, made in the company's own handle plant. These shovels are made in a complete line of plain back, hollow back and back strap patterns, and a variety of handles, both the long, wooden D, malleable D and malleable Dirigo. Every shovel is subjected to several tests. After being heat treated the blades are tested in a Brinell machine which records the hardness of the steel. The handles are tested to a bending stress of 200 lb. and the finished shovel when assembled is subjected to a rough and ready test. Only then is the Red Edge painted upon this shovel, indicating that it is perfect in every respect and that it is fully guaranteed by the Wyoming Shovel Works.

PUBLIC WORKS.

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 49 FLORAL PARK, OCTOBER 9, 1920 No. 15

Garbage Incinerator at White Plains

Garbage, rubbish and ashes burned in a twenty-ton incinerator costing $12,500. Mixed refuse is now collected by contract for one year, but city may adopt municipal collection

For a number of years the city of White Plains, New York with a population of 22,000, has been disposing of garbage and ashes which it collected by filling in such low places in the city as could be found. Public sentiment and complaints from citizens in the vicinity of the dumping grounds convinced the officials some time ago that it was necessary to change this procedure and build an incinerator.

It was decided to erect the incinerator building upon a lot of approximately three-quarters of an acre situated in the extreme eastern part of the city, immediately adjoining other property owned by the city on which was located a sewage pumping station. The cost of the ground was $2,500. This location is apparently as advantageous as any that could have been selected for that purpose. The old portion of the city, where the bulk of the residences and business buildings are, is bounded on the north, west and south by hills that are approximately 200 feet high. The location of the plant is such that the loads will not have to be drawn up hill from any point, although the length of haul averages perhaps about one mile. The plant is about 400 feet from the main highway, which is well paved.

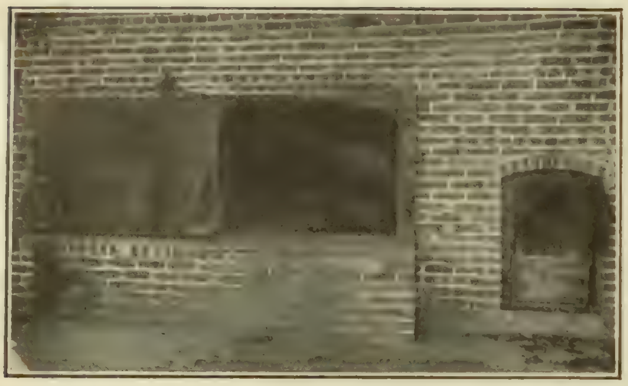
The garbage and ashes are collected without separation at the present time under a contract, for which service the city pays $1,500 a month. There is a provision in this contract by which separate collection may be made at an increased cost of $100 per month. The public works commissioner, W. B. Lyon, is considering changing the system and having the collection made by the city, feeling that in the end this would be more satisfactory. Contracts can be let for only one year and he feels that it would be unreasonable to require the contractors to purchase trucks and other equipment of a modern nature when there is no certainty of the continuance of the contract.

The incinerator is the No. 11 type of the Nye Odorless Crematory Company, and has a guaranteed capacity of from 20 to 25 tons in 24 hours. In the test made for the city officials, 7 tons of mixed garbage and refuse was disposed of in 10 hours and no extra fuel was required. The officials considered this satisfactory and thereupon paid the contract price, $12,500.

The commissioner of public works figures that when the plant is run for 24 hours, four men will be required and that the plant will take care of all of the garbage of the city.

EXTERIOR VIEW OF WHITE PLAINS INCINERATOR

CHARGING FOOR OF INCINERATOR



DOOR FOR LARGE ANIMALS AT LEFT FIRING DOOR AT RIGHT

The building which incloses the incinerator is 38 feet 6 inches by 29 feet 9 inches outside dimensions and is constructed of brick, with a slate roof. The main floor is of concrete and the charging floor is of reinforced concrete slab and beam construction and is 9 feet 10 inches above the ground floor. The furnace proper is 13 feet wide by 14 feet 4 inches inside. One half is provided with a grate consisting of 28 double bars (56) bars in all), while the other half is floored with brick. Over the grate bars, in the charging floor above, is the charging chute, while over the brick floor, which is used as a drying hearth, is a wet garbage chute. There are two firing doors on the long side of the grate and one firing door and air duct at each end. At one end of the drying hearth is a door 4 feet by 2 feet 6 inches which is used for placing large animals on this hearth, while at the opposite end of the hearth is a small door and opposite it a hand winch used for drawing the animals through the large door onto the drying hearth. Back of the drying hearth is the chimney, which is 2 feet 6 inches in diameter, constructed of steel with a fire-brick lining 4½ inchs thick. Garbage wagons are driven up a ramp onto the charging floor, dump their garbage and drive out the rear door and around the building to the main entrance to the property. The garbage is raked from the floor into the charging chutes in the quantities desired.

The contract for the incinerator was a very simple one. It required that the company furnish a "standard brick incinerator of the Nye Odorless Crematory Company," the city furnishing the site and removing all trees, rock, etc., and making the site ready for building operations, grading and making the necessary roadways. The company agreed to demonstrate that the plant has a capacity of 20 to 25 tons of "average city-run garbage, trash, waste paper and dead animals per day." For making the test, the city was required to deliver to the crematory such available city-run garbage, etc., and fuel (if needed) as was necessary for testing the crematory, and also to furnish the services of two men so that the company's representative, while testing out the crematory, could teach the city's operators how to use and operate it. The company guaranteed the crematory to burn the matters named "without obnoxious odors from furnace or smokestack, when operated according to direction." It agreed to furnish and equip the building and incinerator in 120 days, but, owing to certain conditions beyond the control of the contractor, it required about two weeks longer to complete it. The commissioner of Public Works seems to be thoroughly satisfied with the plant, which has now been in operation for several weeks.

Accounting Forms on Construction Work

By Allen Henry Wright

Methods followed on the municipally owned project at Barrett Dam, in California.

Among the many problems to be handled upon any large construction project is that of mess accounting, and this is true whether the project is being carried through under contract or by day labor under a general superintendent.

One of the chief construction jobs now in progress in Southern California is that at the Barrett damsite, on the water conservation system belonging to the city of San Diego. The hydraulic engineer in charge of the work is H. N. Savage, who, in 1919, completed the new Lower Otay dam, also on the municipal water system, and who had been employed on many large projects throughout the southwest and the northwest.

The lower Otay dam had been started under a contract, but the contractor failed to make satisfactory progress and the job was taken from him and completed under Mr. Savage's direct control.

When the million dollars was voted for the construction of the Barrett dam, it was decided by the Common Council of San Diego to carry on the work by day labor rather than under a contract, and Mr. Savage was continued in the city's employ as hydraulic engineer.

Upon the Barrett dam project a system of accounting forms which had been in vogue at the Lower Otay work was continued, with improvements, and as these forms have proved so satisfactory here it is believed that they may be adaptable to other large projects in the country. The Barrett dam project being wholly a municipal matter, the forms in use there are naturally inter-departmental in their nature, but the general idea can be carried out on any contracting job.

On this project the chief steward submits a daily mess report (see Form No. 7) covering the five meals served during the twenty-four hours (the job being carried on under two shifts), his form card showing the number of men served at each meal, whether at the $1.15 or the $1.25 per day rate, the number of meals served the mess force, the names of guests served and the number of meals served them and the account to which their meals are to be charged.

The chief clerk on the project keeps a continuous inventory of mess stock, and prepares a monthly statement showing the range in prices and the cost per meal per capita. From his May report, for instance, it is found that a total of 5,870 meals bringing in revenue and 1,294 meals, non-revenue returning, were served, making an average of 1,058 meals served per mess employee.

The unit cost per meal served during May was $.4108, which showed a net loss per meal of $.0214. In computing the cost per meal, the following enter into the total: Supplies, food, $.2973; supplies, fuel and miscellaneous, $.0075; freight and handling, $.0101; labor, $.0818; overhead, $.0047; depreciation (estimated on a basis of writing off full cost of mess-house and equipment during the life of the project), $.0094. The actual revenue received for each meal served is $.3894; and this being an established price, there is a variation from month to month in the loss or gain per meal served, accordingly as the price of food-stuffs advances or drops.

It is interesting, in this connection, to note the fluctuation in these prices during the period between December, when the work on the project was started, and May. Sugar showed an advance of 110%; flour, 14%; potatoes 117%; condensed milk, a decrease of 25%; beef, increase of 10%; ham, 27%; bacon, 25%; macaroni, 15%; butter, decrease of 13%; eggs, a decrease of 33%.

In connection with the Barrett project there is conducted a commissary store, and the men in charge of this make a daily report through the chief clerk, showing cash on hand and the receipts from various sources, with a balance struck at the close of each day's business. (See Form No. 10.)

Each man on the project has an individual card in the office records, and to it are posted each day a record of hours worked, as shown by the time-keeper; the rate of pay, deductions for board, rent of room, ticket-books for use at commissary, transportation, etc. (Form No. 21) If an employee terminates his services before the regular bi-weekly payroll goes into the office of the city auditor, he is given a special card (Form No. 27) which he can present for immediate payment. This card shows, in condensed form, the data which appear on the serial card in the office of the chief clerk on the project. There is also a form (*No. 28*) which each employee must present to the city auditor in any case before he can draw the money set out on the regular payroll. This guards against any unauthorized person calling for a pay warrant due an employee.

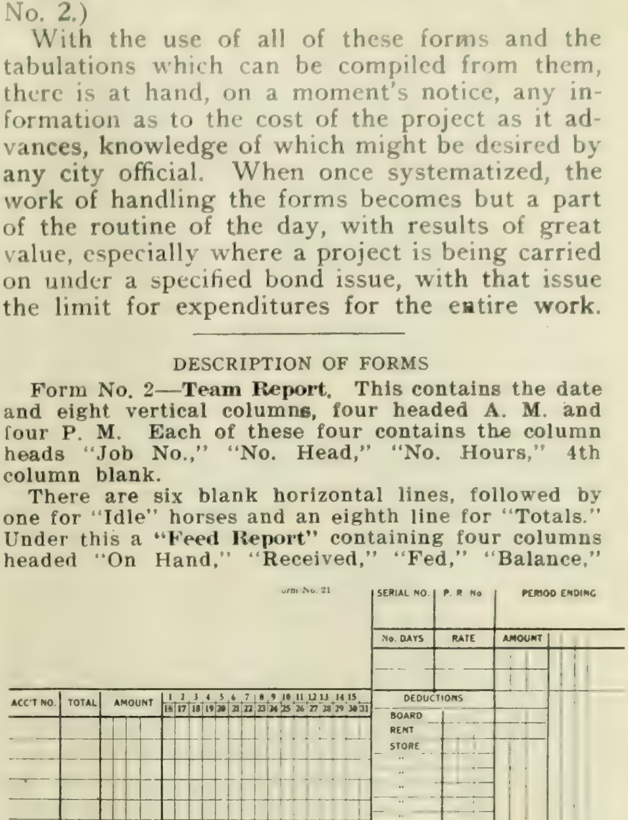
Throughout every phase of the Barrett project are used forms of one kind or another, but every one has its purpose and value. Among these other forms are those kept for daily reports by the powderman in charge of explosives (Form No. 3) and the foreman of the stables (Form No. 2.)

With the use of all of these forms and the tabulations which can be compiled from them, there is at hand, on a moment's notice, any information as to the cost of the project as it advances, knowledge of which might be desired by any city official. When once systematized, the work of handling the forms becomes but a part of the routine of the day, with results of great value, especially where a project is being carried on under a specified bond issue, with that issue the limit for expenditures for the entire work.

DESCRIPTION OF FORMS

Form No. 2—**Team Report.** This contains the date and eight vertical columns, four headed A. M. and four P. M. Each of these four contains the column heads "Job No.," "No. Head," "No. Hours," 4th column blank.

There are six blank horizontal lines, followed by one for "Idle" horses and an eighth line for "Totals." Under this a **"Feed Report"** containing four columns headed "On Hand," "Received," "Fed," "Balance,"



Form No. 21

SERIAL NO. | P. R. No | PERIOD ENDING

No. DAYS | RATE | AMOUNT

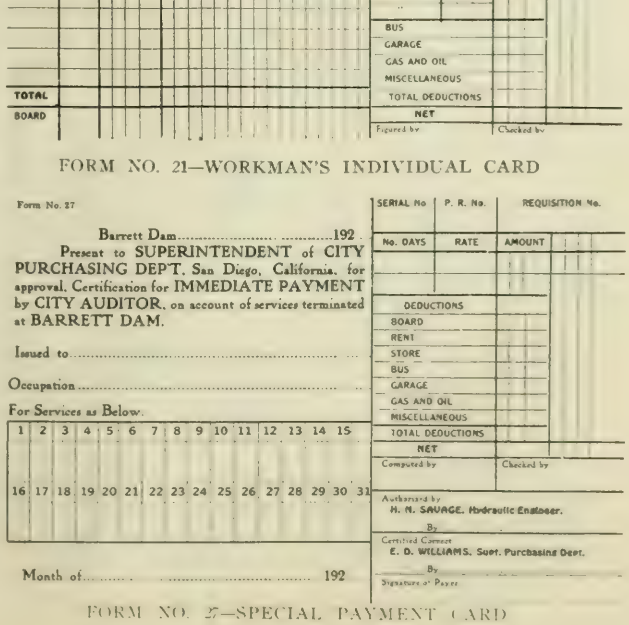
ACC'T NO. | TOTAL | AMOUNT | 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 / 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

DEDUCTIONS
BOARD
RENT
STORE
"
"
"
"
"
"
"
"
BUS
GARAGE
GAS AND OIL
MISCELLANEOUS
TOTAL DEDUCTIONS
NET

TOTAL
BOARD

Figured by
Checked by

FORM NO. 21—WORKMAN'S INDIVIDUAL CARD



Form No. 27

Barrett Dam...192

Present to SUPERINTENDENT of CITY PURCHASING DEP'T, San Diego, California, for approval. Certification for IMMEDIATE PAYMENT by CITY AUDITOR, on account of services terminated at BARRETT DAM.

Issued to..

Occupation..

For Services as Below.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

Month of..192

SERIAL No | P. R. No. | REQUISITION No.

No. DAYS | RATE | AMOUNT

DEDUCTIONS
BOARD
RENT
STORE
BUS
GARAGE
GAS AND OIL
MISCELLANEOUS
TOTAL DEDUCTIONS
NET

Computed by
Checked by

Authorized by
H. N. SAVAGE, Hydraulic Engineer.
By

Certified Correct
E. D. WILLIAMS, Supt. Purchasing Dept.
By

Signature of Payee

FORM NO. 27—SPECIAL PAYMENT CARD

with two horizontal lines "Barley—No. of Sacks," "Hay—No. of Bales." This is signed by the foreman.

Form No. 3—**"Daily Explosives Report."** This is divided into three parts, **"Explosives Used"** and **"Explosives Received."** The first contains' columns headed, "Job No.," "40%," "5%," "Blasting Caps," "Fuse," "Exploders." Under **"Explosives Received"** are the same headings, except that the first column is headed "Requisition No." This is followed by Remarks, date and signature of powder man.

Form No. 7—**"Mess Report."** This is divided into two vertical sections, one for recording the number of meals and the other the guests served. The former contains four columns headed "$1.15 Meals," "$1.25 Meals," "Mess Force" and "Total"; with space for recording the number for each of the five meals indicated as A. M., Noon, Afternoon, P. M. and Night, and a total footing. Under the heading of **"guests"** is entered the "Name," "Meal" and "Account."

Form No. 10—**"Daily Commissary Report."** This contains two columns, one for items and the other for totals, with horizontal lines for each of the following: "Cash on Hand," "Cash Receipts—Commissary," "Pool," "Barber," "Charge Items," "Coupon Receipts," "Total Sales," "Total Cash," "Cash Turned in," "Coupon Redemptions," "Total Credits," "Cash on Han." The cash on hand at the beginning and end of the day, total cash and total credits, and barber, are entered in the total column, the others in the item column.

Form No. 28—**Auditor's order.** This contains the date followed by the words: "H. L. Moody, Auditor: Please pay bearer................whose signature appears below, the amount due him on pay roll No. ....Page No. ....Line No........ This is followed by an itemized statement with the following items: "Net payroll amount due," "Less further deductions from warrant for Meals," "Bus," "Miscellaneous;" "Total deductions from warrant," "Net amount due payee." At the bottom is space for signature of the chief clerk and of the payee.

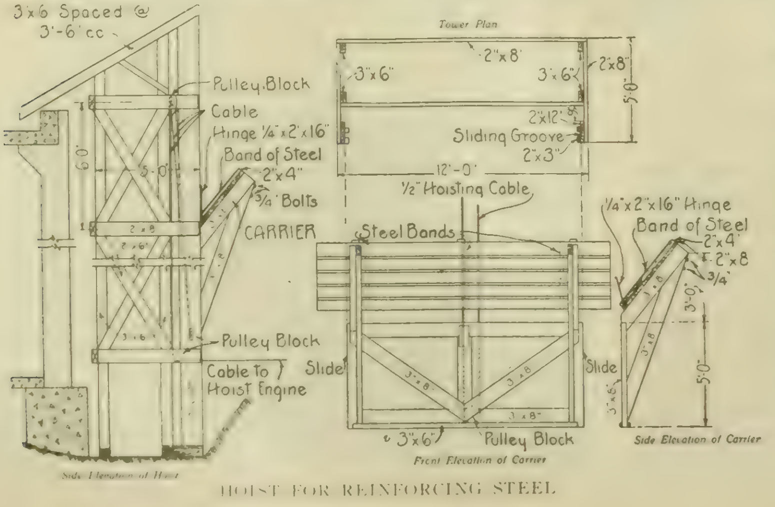
Reinforcement Hoist*

For the handling of more than 500 tons of reinforcing steel and more than 200,000 feet of lumber used in the construction of the 60 x 700-foot 5-story "Victory" building at Johnson City, New York, there was installed a 12 x 5-foot wooden hoisting tower with a pair of vertical guides off-set about 18 inches on centres from the corner posts of the 12-foot outer space of the tower.

The carrier consists of an inclined 3 x 14-foot platform mounted on the top of a braced framework that engages the hoisting guide. The long units of steel, timber or other material that are placed on the platform may project beyond it at both ends and are securely retained in the V-shape space between the platform and the space of the tower, besides being secured at the lower part by the 15-inch loose leaves of strap hinges fastened to the platform.

The hoist line is attached to the lower part of the platform framework so that it can elevate the platform above the sheave over which the cable returns to the hoisting engine and thus raise the platform to the top of the tower to register with the projecting side of inclined skids which cap the tower. On reaching this position, the lose leaves of the strap hinges automatically revolve down into contact with the tops of the skids, release the material on the platform, permitting it to slide on steel bearing strips and be discharged over the skids to the required position in the building.

The tower may be designed so that a concrete bucket can be hoisted inside while the steel hoist is operated outside.



HOIST FOR REINFORCING STEEL

U. S. Bureau of Labor Statistics reports a decrease in number of employees on payrolls of 10 out of 14 representative industries in August, 1920, as compared with July; automobile industry showed decrease of 10 per cent; woolen industry, 6 per cent; leather industry, 5 per cent; car building showed increase of 3.5 per cent and paper making 1.5 per cent. This should release men for employment on construction work.

Ice Cores for Concrete

A novel suggestion has been made that hollow concrete be constructed with ice cores that will automatically remove themselves after the concrete has set, by melting and draining through small outlets left for the purpose. If successful, this would permit the construction of practically closed concrete chambers and eliminate difficult and costly stripping of the interior forms. The presence of the water would probably be beneficial rather than injurious in that it would promote the satisfactory hardening of the concrete.

Theoretically the suggestion seems possible and might be practical as well in latitudes where there is available an unlimited supply of thick ice to be had for the cost of cutting and handling. With ice at such prices as it commands in most American cities and requiring to be hauled. assembled and fitted in position, it is doubtful whether much practical use could be made of it for this purpose in large construction.

There are, however, various cases in which it might prove exceedingly advantageous, as for instance, in making small hollow blocks for spe-

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*Excerpt of article in the *Contractors Atlas*, by C. J. [illegible] construction manager, Tompson & Binger Engineers & Contractors, Syracuse, N. Y.

cial structures where it is desired to have an inaccessible hollow interior that would justify considerable expense in providing a self eliminating core. For construction where a large hollow space is required, interior forms might perhaps in some cases be built with walls of ice laid up like stone masonry, cementing itself together and braced occasionally by ice struts, construction of this sort having proved feasible and strong in the building of various Ice Palaces at Montreal and St. Paul. One thing is, however, certain namely that such forms for cores do not possess the advantage of steel forms for repeated re-use.

War Construction Justified

The reports dealing with the expenditures of the War Department on war contracts were reviewed by the Bulletin of the Associated General Contractors, which review is abstracted below.

The August bulletin of the Associated General Contractors, reviewing the "Graham" report of the select committees on expenditures in the War Department that accused the contractors for much of the important emergency work of inefficiency and dishonesty, analyzes it and the report of the non-partisan Board of Review of Construction, which, although received by the government August 30, 1919, long before the Graham report was written, was not made public until August, 1920.

This Board's report which was made by eminent distinterested engineers gives praise and appreciation to the contractors for their loyal services. The 400-page report itself is a record and analysis of construction policy, of great value to engineers and architects.

The principal charges of the Graham report are; that the chairman of the Emergency Construction Committee of the Council of the National Defense showed favoritism in the selection and rejection of contractors; that the chairman and committee wasted $80,000,000 by the rejection of the competitive bids system and the adoption of the cost-plus-percentage form of contracts that encouraged inefficiency, the waste of materials, the dragging of work from job to job, petty graft, and the payment of exorbitant fees to contractors.

The Board of Review strongly recommended the employment of the most experienced personnels securable, irrespective of business connections, and that large discretion and authority should be granted to them. It found that such construction work so placed was done with remarkable speed, was superior in quality, was characterized by economy of design, and was as economically performed as the requirements for speed and other war conditions permitted.

Great care was taken in the selection of contractors and through data selected from questionaires covering the magnitude and kind of work they executed, number of men employed, their financial resources and the reports from banks, financial agencies, customers and confidential sources, a list of 3,500 contractors was formed from which the most desirable were selected to execute the work. These were chosen with regard to a list of ultimate requirements, all of which had to be met and which included two years of successful contracting experience, the excavation of a $500,000 contract, performance of work similar to that under consideration, possession of plant, proof of a capable organization, use of an accounting system satisfactory to the government auditors, the filling of a sworn statement of the work executed within the past two years, and the names and addresses of owners, engineers and architects in charge.

The finding of the Board of Review that the use of the cost-plus form of contract, if properly developed, is well justified and that it contributed to the success of the emergency construction program which could not probably have been performed as well and quickly without it or its equivalent, was practically endorsed by the report of a special committee of the presidents of the five great technical societies, the General Contractors Association, and the American Federation of Labor and building construction employes, who unanimously recommended the use of this form of contract, as equitable in operation and advantageous to the government.

The inefficiency of labor was attributed to the shortage of good labor, the use of floating labor, to the impossibility of penalizing inefficiency, and to the impossibility of carefully selecting men. The high cost of labor was due in large degrees to the necessity for overtime and the difficulties in keeping the men on the job.

Several investigations of specific materials showed that the carefully recorded waste amounted to about 6 to 10 per cent. The normal waste of lumber on work of this character was fixed at 10 per cent. As lumber formed the largest item of material used in camp and cantonment construction, it is considered representative of other materials. The committee found that it was often thought to be for the government's interest to keep together and transfer to new work, the organization of a contractor and government constructing officer that had already secured good results, thus disposing of the charge of dragging the work along to employ the contractor's forces.

The board found that there was very little evidence of deliberate plans to cheat or defraud the government, the percentage being sub-normal.

For the 16 national cantonments, it was estimated that the contractors' fee averaged less than 2 per cent net profit, an amount that was still farther reduced by federal taxation. For the much less costly national guard camps, the average fee was 6.88 per cent of the cost, and on some of the larger projects, the gross fee of the general contractor was aout 1¼ per cent, from which he had to meet his own expenses and taxes.

That the money was well expended is obvious from the fact that the total cost of the cantonments was about $200,000,000, and as the average daily cost of the war to the United States was about $30,000,000, the total cost was justified had it shortened the war by only one week. They were actually completed in time to give service of inestimable value during the winter of 1917 and 1918. Without the extreme rapidity of construction, it is believed that the housing would have been greatly delayed and with it the embarkation of American troups, forming a condition that might have seriously influenced the issue of the war.

San Francisco's Municipal Railways

The following letter has been received from Paul Eliel, director of the San Francisco Bureau of Governmental Research, "an incorporated, nonpartisan citizens' agency to study public business, co-operate with officials, and specifically work for economy and efficiency in municipal affairs."

My Dear Sir:

In your issue of September 4th I note an article in regard to the San Fransco Municipal Railways. The results of last year's operation actually show a cash deficit after the payment of operating expenses, bond interest and redemption, depreciation and accident reserve and other expenses, of slightly in excess of $16,000. The charter of the city requires the road to show in the operating statements certain so-called comparison charges. These charges are those which the road would be required to pay if it were operated under private management. They amount to something in excess of $205,000 per annum. In other words, if the road had been privately operated the loss for the past year would have been in excess of $220,000.

There has really been no agitation in San Francisco for the installation of one-man cars. The failure to put them on is not due at all to the fear of the supervisors that a considerable number of employes would have to be discharged, but is due entirely to the fact that, with one or two exceptions on extremely short and unimportant lines, the nature of the territory traversed by the city lines is such that the use of one-man cars would be inadvisable.

The statement that fares are not raised because it would increase the income of the privately operated company which would not raise their fares, is, I believe, entirely erroneous. The privately operated United Railroads would be more than glad of an opportunity to raise their fares, as their loss far exceeds that of the city. They do not feel, however, that they can apply to the Railroad Commission for an increase until the city has made the first move.

Finally, although it is true that certain amount of money has been transferred from the Depreciation Fund to the Operating Fund, in order to care for the increased pay of platform men granted more than a year ago, the past accumulation in the Depreciation Fund has not been affected; and on account of the method of accumulating the Depreciation Fund as a percentage of gross operating revenue, with the steadily increasing revenue, the amount actually transferred to the operating account has not materially affected the amount which formerly should be in the Depreciation Fund.

A recent proposal to raise the platform men to $6.00 per day, and to secure the additional revenue from the Depreciation Fund, was denied, and I believe it is now generally recognized that if any increase in wages to the platform men is to be paid, it must come through an increase in fare.

Very truly yours,
PAUL ELIEL, *Director.*

Driving Long Battered Piles

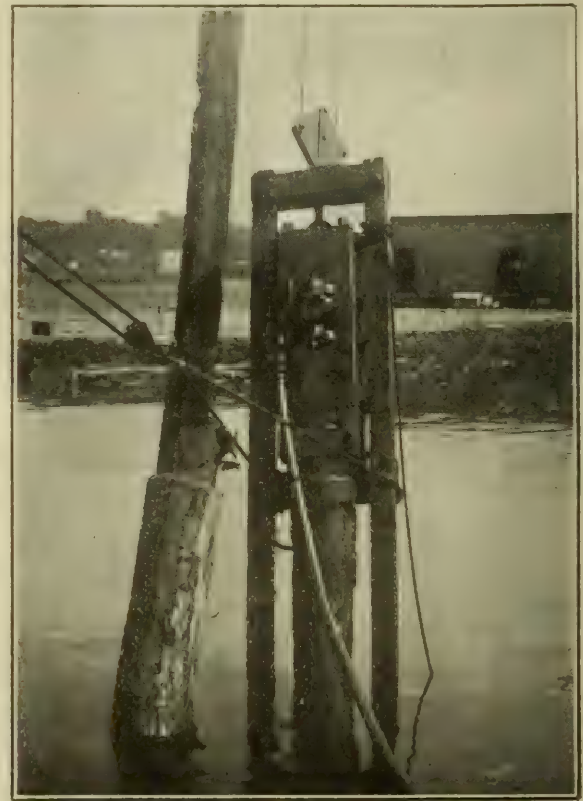
Steam hammer in short swinging leads suspended from derrick boom.

In the construction of the barge canal terminal in Flushing Bay, Flushing, Long Island, the McHarg-Barton Company, New York, have driven a large number of long foundation piles, including several hundred spur piles 17 to 19 inches in diameter and 80 to 85 feet long, which are inclined about two horizontal to six vertical.

They are driven to an average penetration of 55 feet through clay and mud strata to bearing in a heavy blue clay, without the use of a pile-driving tower or the elaborate mechanism often employed for driving battered piles.

The water is 14 feet deep at low tide and 20½ feet deep at high tide, and the piles have a 6-foot cut-off making an approximate total of 26½ feet which is not driven. Subtracting this amount from the pile length gives the penetration of 53½ to 58½ feet.

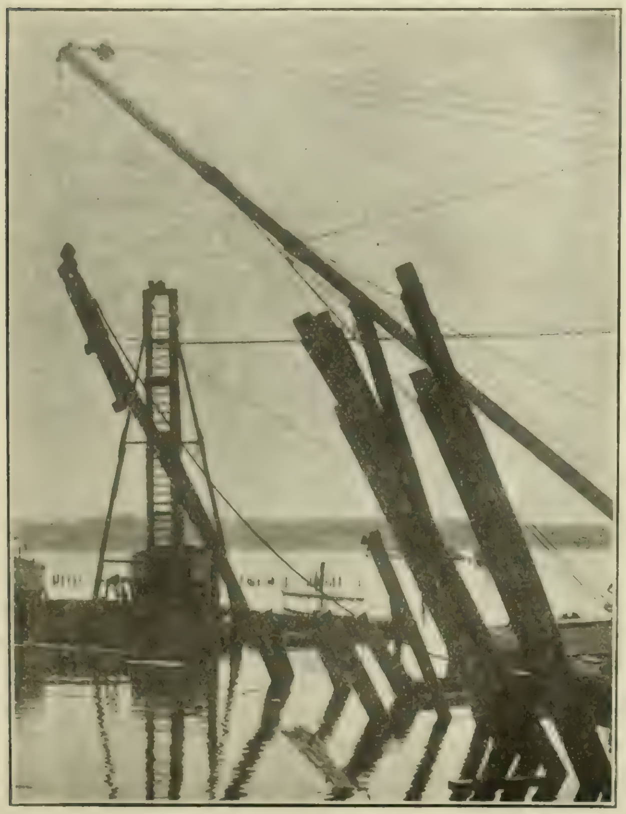
The piles are set in position by a floating derrick and penetrate the mud several feet by their own weight. The tops are guyed and pulled into position giving approximately the required angle, at which they are maintained by the guy ropes while the pile is driven by No. 7 McKier-



STEAM HAMMER AND WAYS ATTACHED TO PILE TOP nan-Terry double-acting steam hammer making about 225 strokes per minute. The hammer weighs 5,000 pounds and the striking part weighs 800 pounds, giving it a high efficiency which drives the piles at an average rate of 32 in one 8-hour shift. The refusal point was when the piles had been driven so they would not move over 1 inch under 100 blows of the hammer with steam pressure at 90 to 100 pounds.

The pile hammer operates in a pair of 6 x 6-inch swinging timber leads or guides, with 2-inch planking extending about 8 feet below the butt of the pile, thereby affording a better support for same. The leads and hammer are handled by a hoisting tackle operated from the end of a 78-foot derrick boom, which is very quickly adjusted to the required position for successive piles. The swinging leads were not attached to the top of the pile but were suspended from a direct line in such a manner that they maintained the desired inclination at which the pile was to be driven. The hammer was also free to work up and down in the short leads. At the bottom end of the leads there was a half round iron strap which permitted of the leads being pulled up against the pile so that they centered with the pile top for driving.

The efficiency of the driving is demonstrated by the fact that several piles of similar lengths and character in the same locality that had been driven to refusal with a 3,600-pound drop hammer were, after they had set for more than six weeks, driven about 1 foot deeper by the hammering above described.



DRIVING SPUR PILES WITHOUT TOWER. HAMMER SUSPENDED FROM DERRICK BOOM

This unique method of operating the hammer was designed, constructed and operated by J. S. Mosher, superintendent of McHarg-Barton Company, New York, contractors for the work.

Motor Fire Apparatus and Fire Stations

In his report for the year 1919, the superintendent of the Department of Public Saftey of Easton, Pa., W. P. Strickland, cites several instances in support of his contention that the use of motor fire apparatus by that city permits a reduction in the number of fire stations that were used when horse-drawn apparatus was relied upon exclusively. He states that "The equipment carried by a modern motor apparatus is equal to that formerly carried on three pieces of the old style horse-drawn apparatus, to say nothing of the greater advantage of reaching the scene of the fire more quickly. Besides that, every fireman responding to an alarm goes into active service the instant he reaches the scene. No time is lost in looking after the horses, as was the case in former days. Any portion of the city, as comprised within its present limits, can be reached by apparatus from the central station in five minutes."

The records show that in the case of alarms from the furthest possible locations in one section of the city, apparatus reached the box and sent backtaps in seven minutes in one case and ten minutes in another after the alarm had been sent in. From the furthest box in another section backtaps were sounded within nine minutes, and the longest period from the furthest box in still another direction was six minutes.

"It having been shown that the motor apparatus is capable of reaching each and every part of the city within a very short period, the necessity of maintaining as many stations as we now have is not apparent. By the elimination of two stations we would save annually about $2,500, which would meet the salaries of two additional permanent men." He recommends that, in addition to eliminating two stations, the call-men be dispensed with, as being unnecessary; in which case these two savings would permit the adoption of the two-platoon system.

Water Pollution Law of Rhode Island

Beginning September 1st there went into effect in Rhode Island a new law enacted by the latest legislature to regulate and prohibit the pollution of inland and tidal waters of the state. The act created a Board of Purification of Waters which will have practically unlimited power in investigating complaints of pollution of waters (except in the case of potable waters) and compelling the installation of such systems or means of preventing pollution as it may deem advisable. While in the past the courts have invariably granted the relief sought from improper use of streams, the laws have not been considered satisfactory and hence the new laws and the board to enforce them.

Water Metering in Watertown

The water department of Watertown, N. Y., has started the installation of 2,000 meters which they hope to have completed by the end of this year, 500 of them having already been installed. The superintendent of the department, J. W. Ackerman, reports that the meters have already reduced the average daily consumption of water by a million gallons a day, comparing the record for August, 1920, with the first seven months of this year and also with August, 1919, the consumption having been but little over five million gallons a day in August, 1920, while it was 6,450,000 gallons in August, 1919.. It is expected that, as the number of meters increases, the decrease in consumption will continue and that by January of 1921 the consumption will drop to an average of four million gallons a day or less.

This lowering of consumption reduces the cost not only of pumping, but also of chemicals, which cost about $8 per million gallons of water treated.

Water Works Department Aids City Finances

In his report for the year ending January 5, 1920, Samuel F. Hassler, superintendent of the Bureau of Water and Light of Harrisburg, Pa., reports that the water department from its reserve fund appropriated $11,500 for the aid of other city bureaus which were temporarily embarrassed, the Bureau of Fire receiving $4,000, Bureau of City Electrician, $4,000, Bureau of Ash and Garbage Inspection, $3,500. An ordinance was passed permitting this appropriation with the understanding that the amount was to be returned to the reserve fund of the water department at an early date.

Municipal Horseshoeing in Waltham

Waltham, Mass., maintains a blacksmith shop where is done all the horseshoeing and blacksmith work of all the city departments. During 1919 the blacksmith was engaged 1,032 hours at work other than horseshoeing for the Street Department and 464 hours for other departments, while presumably the rest of his time during the year was employed in horseshoeing. Four hundred and eight horses were shod at a total cost of $975, this involving the placing of 1,084 plain shoes, 20 bar shoes, 20 drive calk shoes, 16 rubber pads, 313 leathers, 48 shoes reset and 58 shoes sharpened.

Refuse Collection in Waltham

In Waltham, Mass., the Street Department collects the ashes and refuse. Ashes are collected weekly, a given day being assigned for the work in each ward. During 1919 the department used for this work Autocar trucks for 166⅝ days, a Kelly-Springfield truck 2¼ days, double teams 511⅜ days, and single teams 9 days. The Kelly-Springfield truck collected 96 cubic yards in 12 loads, the Autocar trucks 6,591 cubic yards in 1,498 loads, the bottom-dump carts 12,173 cubic yards in 2,969 loads, the single tip-carts 56 cubic yards in 35 loads, and 1,500 cubic yards were collected in 300 loads by double sleds.

In the collection of refuse, the first four days of each week are devoted to stores and factories and the last two days to collections from residences. The rubbish is collected and disposed of at a dump, where it is sorted and the paper is baled and sold. Two men are employed on three public dumps. The total cost of labor at the dumps for the year was $2,393.90.

Highway Construction Prices

The State Highway Commissioner of North Carolina has issued the following circular letter addressed to North Carolina Highway Contractors:

"As information concerning current prices in road construction, we beg leave to quote below the prices on which we have recently let contracts in this State:

Clearing and Grubbing, per acre	$75.00	$150.00	$200.00
Common Excavation, cu. yd.	.54½	.58	.55
Borrow Excavation, cu. yd.	.54½	.58	.58
Solid Rock Excavation, cu. yd.	1.90	2.25	
Top Soil Surfacing, cu. yd.	.75	.72	.70
15 in. T. C. Pipe, Lin. Ft.		2.10	2.00
18 in. T. C. Pipe, Lin. Ft.	2.00	2.75	3.00
20 in. T. C. Pipe, Lin. Ft.			
24 in. Corrugated Pipe	3.00	4.00	4.00
15 in. Corrugated Pipe			3.50
18 in. Corrugated Pipe			4.00
Concrete Headwalls, Class B, cu. yd.	35.00	30.00	30.00
One Course Gravel Surfacing, cu. yd.	2.00		
Overhaul	.01	.04	.04
Concrete Structures, Class A.	35.00		
Reinforcement Steel	.11		
Bolts and Plates	.11		

Convict Labor on Kentucky Highways

The State Highway Commission of Kentucky is suing the State Board of Charity and Correction of that state to compel it to honor a requisition for 500 prisoners to work the roads next year. The board has refused to comply with such a requisition on the ground that there are no more than sufficient prisoners to fill the contracts with prison shops, to which the board is bound by contracts to furnish the prisoners desired to the extent that they are available. As it is necessary for the state to know in advance what next spring's program will be, this suit is brought for the purpose of clearing up the situation.

The state highway engineer, M. S. Boggs, says that the commission is planning to establish permanent road camps, eight camps this year having satisfied him that prisoners can be employed successfully in highway construction at a cost of $1.50 a day. The commissioner of public institutions, Joseph P. Byers, is reported to desire to avoid the expense of sending the men out early in the spring and returning them to prison in the fall, as well as the disorganization of the contractors' plans by filling their shops for five months in the winter and then leaving them short-handed for the other seven months.

Contractors at present have less than two-thirds the number of men their contracts called for, owing partly to a reduction in prison population and partly to the fact that fifty men are working on the roads in several counties. The state has contracts for 1,625 men, with a prison population of only 1,133, of which 10 per cent are required for duty in the kitchens, engine rooms, dining rooms, hospitals, barber shops and offices.

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Municipal Bonds in Demand

The demand for bonds is increasing, and consequently their market value, and municipal bonds are leading the entire investment market. During September the market quotations on high-grade city and state bonds advanced as much as three or four points in the case of long-term issues. Moreover, the last few weeks have seen a falling off in the volume of offerings of new issues of this kind, and the combined effect would seem to be invitable further increase in value.

Prices of materials are going down, labor is becoming more abundant and reasonable, and the indications are that construction work can be carried on under much more advantageous conditions next year than this.

With these conditions prevailing it would seem to be wise for cities to prepare plans now for the carrying out of some, at least, of the several public works projects which almost every community has been postponing since the beginning of the war.

Factors in New Construction

Construction work which is to be undertaken or continued next season should be carefully planned in advance, and it is none too soon now to begin preparations for its most profitable execution and to decide what kind of work and how much is to be attempted and the methods best adapted for it. Before undertaking any construction work, consideration must be given to the class, amount, conditions of execution, the nature of the contract provision or type of contract, and payment, as well as to labor and materials required, and transportation and plant to be installed, all of which are vital factors in determining success or failure, any one of which may make all the difference between profit and loss.

The contractor should deliberately plan whether to engage in road construction, buildings, foundations, tunneling, excavation, concrete work, sewers, water works, or any other general type or special class of construction, according to his experience and equipment, and by timely preparation can usually secure the most advantageous sort of work and avoid that for which he is less experienced or which is less profitable.

The amount of work should bear a suitable ratio to his resources, equipment on hand and organization, and should generally not be great enough to extend over a period of more than one season or one year, unless provision is made for changed conditions in the future. The payments should, of course, be absolutely certain and terms should be so arranged that estimates are made as the work advances and sufficient to cover all of the labor and current supplies, leaving the contractor's assets free for emergencies and the purchase of plant and equipment. If possible, they should be arranged so as to make the heavy payments come early in the work and insure the actual cost of it, leaving a small and diminishing amount of retained percentage for final payment.

Conditions should include a careful survey of the field, an investigation (involving some expense, if necessary) of the natural resources like sand and gravel deposits, locations of spoil banks and borrow pits, storage yards, transportation facilities and subterranean explorations and a knowledge of local meteorological data, city ordinances and the like, together with any difficulties or advantages that may be anticipated and the seasonable time for doing different portions of the work as well as the limited time for its completion, all of which should be scheduled in advance.

The forms of contracts and specifications are of great importance, particularly in work executed for new engineers or owners. No contract should be accepted that contains indefinite or ambiguous clauses or is unjust or unfair in its requirements, as some municipal contracts are notably. Especial attention should be paid to the effect of increasing or diminishing estimated unit quantities or to changes of location or design; and if the items of the contract involve uncertainties such as special danger from flood or quicksand or traffic or labor difficulties, the bids must be high enough on either lump or unit basis to provide for ample insurance, or else the contract should be taken on some cost-plus type of agreement such as is almost universally required now for very large or long-continued work.

Liberal estimates must be made for labor costs —increased wages, delay by strikes, and insufficient or inefficient employees. Competent superintendents and foremen should be certainly available and the leading men should be engaged in advance and employed as soon as possible on preliminary work, while the remainder of the forces are selected, organized and trained for most efficient service early in the execution of the work.

Materials should be contracted for as far as possible in advance, with deliveries provided as required. The contract should permit the quantities to be increased or diminished at a fixed price. When materials, such as sand, gravel, stone and timber can be supplied by the contractor, arrangements should be made in ample time for the location and opening of quarries and the installation of machinery.

Transportation should be provided for by routing different supplies far enough in advance to secure a choice between rail, water and highway carriage, and to permit delivery, if desirable, by automobile trucks, features that can perhaps be greatly modified by the ability to provide ample storage at the site.

Great importance attaches to the selection of plant and equipment, which should carefully be studied with a view not only to the most efficient and economical execution of the work, but also to the utilization of plant on hand, the purchase of standard equipment in the open market or from contractors completing their jobs, and to its future use or sale on the termination of the work in hand.

Boston Refuse Disposal Company to Quit

The company disposing of the refuse of Boston has notified the city that it will be unable to carry out its contract, which calls for continuing the disposal of refuse until July 1, 1922, and requests that it be permitted to cancel the contract effective April 1, 1921. If the city will consent to this, the company agrees to pay it $100,000, which is the amount of its bond, and release all claim it has to the buildings at Spectacle Island, where its plant is located.

This plant went into operation in 1912, although comparatively little actual disposal work was done the first year. It is reported that the city officials were under the impression that the company was making considerable money, but its recent action would indicate that this was not the case. Its own explanation is that, because of poor separation of the refuse into the several classifications of ashes, street sweepings, rubbish and garbage, especially the introduction of much solid matter into the garbage, the expense of treatment had been greater than anticipated and the machinery had been put into such condition that extensive repairs will be necessary at once if it is to continue operating for approximately two years more. In addition to this, labor has increased 150 per cent since the beginning of the contract, gasoline 240 per cent, coal 400 per cent, and the repair parts of the machinery also have increased in price as well as in the number it has been necessary to purchase. The company, The Boston Development & Sanitary Company, has nothing to do with the collection of the refuse, but receives it at the water front and takes it down the harbor to its treatment plant.

Mayor Peters had begun some action anticipatory of the expiration of the contract and was expecting to appoint a committee to consider the broad question of refuse disposal, with the idea that it would have nearly two years in which to study the problem. This action of the contracting company would seem to necessitate hastening matters, leaving only six months in which to prepare for some other method of disposal. It has been suggested that the city may decide to adopt incineration rather than utilization. The plant at Spectacle Island is said to have always given forth odors which have been seriously objected to by neighboring communities.

Philadelphia-Camden Bridge Commission

The joint bridge commission has been selected to have charge of the construction of the bridge to join the cities of Philadelphia and Camden, one of the most expensive bridge propositions now under consideration in the country. The engineers consist of George S. Webster, chief of the Bureau of Surveys, representing Pennsylvania; Lawrence A. Ball of East Orange, N. J., representing New Jersey; and Ralph Modjeski, consulting engineer of Chicago and New York, representing a neutral state. This commission is to "proceed with the work of preparing general plans and a report which shall include traffic census, land values, conditions of foundations and estimates of cost at the three most favorable sites, and the making of recommendations as to the location, height, structure, clearances, capacity, and such other details as may seem to them advisable in planning a bridge over the Delaware river between the cities of Philadelphia and Camden." The expenses of the preparation of the report are to be limited to $100,000, of which the members of the board receive $50,000.

A Century of Immigration

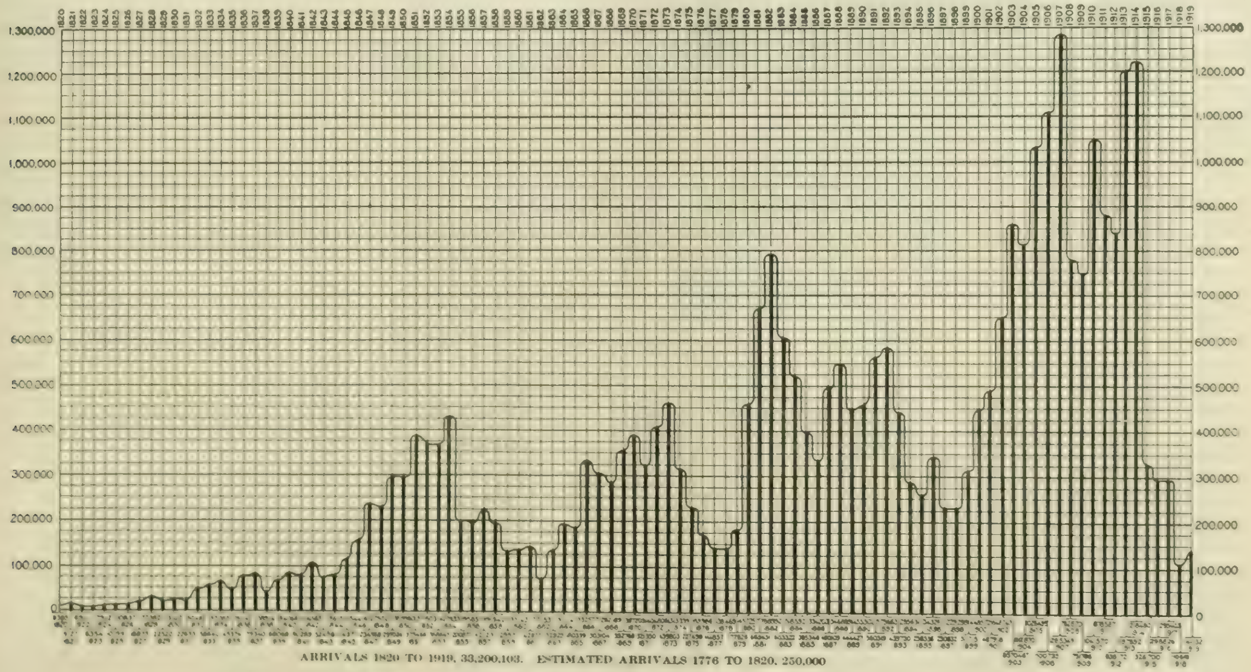
More than 33,000,000 aliens, 90 per cent of them from Europe, have arrived, mostly in four great waves with crests in 1854, 1873, 1882 and 1907.

From the close of the revolutionary war until the war of 1812 there was a considerable but unrecorded amount of immigration into the United States. It decreased during the war of 1812 and after the close of the war in 1815, increased to 200,000 in 1817, a large proportion of the arrivals being sturdy, industrious workers. Nearly all of these became permanent residents and helped to settle and develop the country, as many have since done, but in a proportion decreasing as the area of unsettled territory and of free lands for homesteading has decreased. Meantime larger and larger numbers have been employed in mills, shops and on the vast amount of construction work that required men by hundreds and thousands and an increasing number have concentrated in the seaboard and other large cities. Many have been frankly migratory, remaining in this country only long enough to accumulate the desired amount of earnings which they have carried back to their native countries to invest.

In March, 1819, Federal legislation was enacted that regulated ship transportation of immigrants and provided for recording the number, age, sex and occupations of arriving emigrants. These records, since then much amplified, show that from 1819 until 1919 there have landed in this country 33,076,813 aliens—a number nearly equal to one-third of the present population of the United States, which has increased about 97,000,000 since 1819.

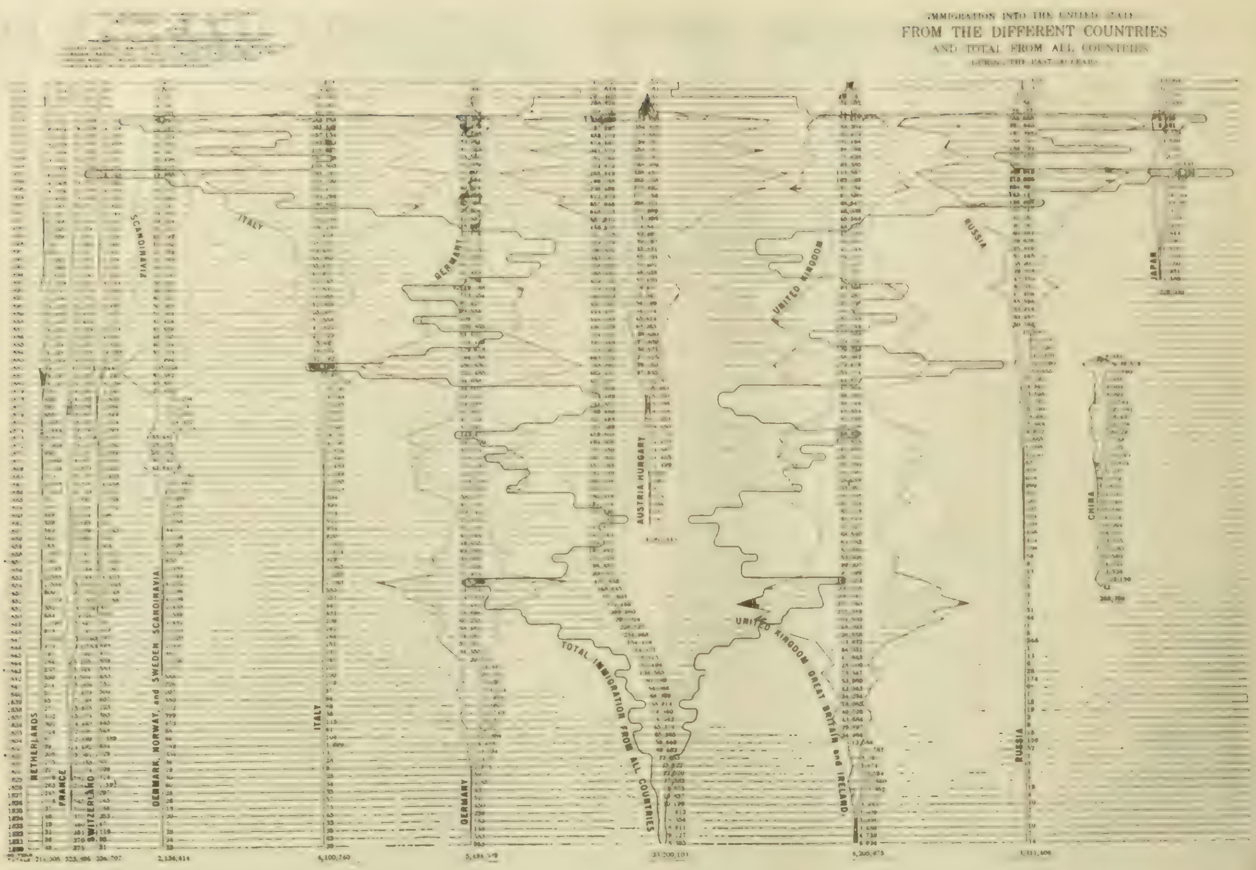
The great majority of the immigrants have been day workers, common labor preponderating, with a goodly number of skilled laborers and artisans employed in special occupations and manufactures. They and their descendants have furnished a large proportion of the manual workers of this country, but in the degree that they acquire citizenship and Americanization, their children enter into more skilled pursuits. With the great increase of productive and construction enterprises, more and more skilled and unskilled laborers are wanted, the demand exceeds the supply and increasing numbers of industrious immigrants are more and more necessary, especially in the present condition of world-wide demands for American products and the urgency of catching up with our deferred maintenance and extensions of all sorts.

The accompanying chart, prepared by the U. S. Bureau of Immigration, shows graphically the varying rates and exact amount of immigration

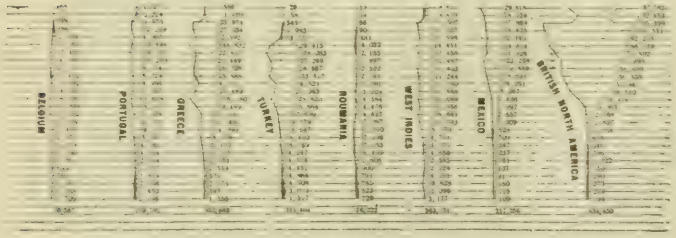


ARRIVALS 1820 TO 1919, 33,200,103. ESTIMATED ARRIVALS 1776 TO 1820, 250,000

IMMIGRATION FROM ALL COUNTRIES INTO THE UNITED STATES FOR 100 YEARS



IMMIGRATION FROM THE DIFFERENT COUNTRIES AND TOTAL FROM ALL COUNTRIES DURING THE PAST 100 YEARS



IMMIGRATION FROM COUNTRIES SENDING FEW ALIENS TO UNITED STATES IN YEARS FROM 1894 TO 1919 INCLUSIVE

for the century closing a few months after the end of the world war. For 27 years, until 1845, the rate was fairly regular, increasing from 8,385 to 114,371. From 1845 until 1918, inclusive, there have been enormous fluctuations, producing four great waves, each with several crests, the major ones being in 1854 (427,833 arrivals), in 1873 (459,803), in 1882 (788,992), and in 1907 (1,285,349 arrivals). These maximums were separated by extreme minimums of 72,183 in 1862, 138,469 in 1878, 229,299 in 1898, followed by a great drop to 110,618 in 1918.

Most of these variations are easily traceable to national conditions, which either forced people to leave their native countries or invited or repelled them here. The first wave was influenced by famine in Ireland and revolution in Germany. The next wave coincided with increased prosperity following our civil war; the third wave corresponded to a great shifting of the source of immigration from northern and western Europe to southern and eastern Europe, which furnished only 11 per cent in 1882 but 75 per cent in 1902. The fourth wave, 1901-1914, inclusive, is the greatest of all and corresponds with great prosperity and enormous construction in this country coincident with serious political, industrial and economic troubles and unrest abroad.

SOURCES OF IMMIGRANTS

At first the great majority of immigrants came from Great Britain and Ireland; after 1820 increasing numbers came from Germany, until its maximum of 1882, followed by a decreased yearly rate of 17,000 to 40,000 from 1895 until 1914, when it almost ceased with the beginning of the world war, the total being much less than from Great Britain.

Italy and Russia were almost negligible until 1882. Since then both have increased steadily and enormously until almost obliterated in 1915 by the great war. Italy sent 32,160 in 1882, a maximum of 77,647 in 1903, and 29,391 in 1914. Russia was 21,590 in 1882, a maximum of about 291,000 in 1913, and 255,660 in 1914. Austria-Hungary was 27,935 in 1881, a maximum of 338,452 in 1907, and 278,152 in 1914. Scandinavia averaged approximately 50,000 per year from 1869 to 1914, with extremes of 11,274 in 1877 and 105,326 in 1882.

Summary of Arrivals from 1819 to 1919

Country	Total immigration.	Per cent of total.
United Kingdom	8,205,675	24.7
Germany	5,494,539	16.6
Italy	4,100,740	12.4
Austria-Hungary	4,068,448	12.3
Russia	3,311,400	10.0
Scandinavia	2,134,414	6.4
Other countries	5,881,887	17.6

During the century more than 90 per cent of the immigrants came from Europe and 2.4 per cent from Asia.

The above data have been derived from the reports of the Commissioner General of Immigration, and are therefore authoritative.

FORECAST

From an analysis of the records and a study of political and industrial conditions in America and foreign countries, the Immigration Bureau concludes that, unless immigration is actually restricted by the United States or restricted or forbidden by European countries, it will greatly increase; the amount dependent largely on the ratio between inducements in this country and the holding power of foreign countries.

Although great discomfort and political unrest prevail abroad, the hope of improved future conditions may keep many of the immigrant class at home; while officers, landowners, small capitalists and others who most feel the burden of changed conditions may emigrate for relief; and this, it is believed, will cause a great increase of immigrants from that class in Germany.

When approximately normal conditions have been restored in central and western Europe, it is likely that Hungarians will find home conditions more favorable, and their immigration will be reduced. In Austria, the present economic conditions are likely to produce heavy emigration. Very large emigration may be expected from Russia, whatever may be the outcome of the political situation there.

Italy, one of the most densely populated countries in Europe, has hitherto furnished the third largest number of immigrants to the United States and notwithstanding heavy losses in man power during the war, is still over-populated and will almost certainly add a large number of immigrants in the future.

It is thought that Turkish immigration may become a factor in the alien exodus from the Near East. No especial change in the immigration movement from France is expected. Immigration from Spain and Portugal was not materially disturbed before the United States entered the war and it is expected it may resume normal conditions except as diminished by the operation of the illiteracy test. A continuance and perhaps an increase of immigration from Great Britain and Ireland is expected.

From the neutral countries a considerable influx of deferred immigration may be expected. It is thought, in the light of former experiences, that future immigration from enemy countries will not long be seriously deterred on account of war feelings.

While it is estimated that perhaps 8,000,000 men of the ages from which most immigrants come were lost in conflict, and many more were injured so as to make them inadmissable to this country, the heavy burdens that European countries must bear will make it so difficult to earn a living and so many men may be released by the disbanding of armies, that there will still be many immigrants available.

From all these conclusions the reader himself may deduce that the facts and conditions indicate a large potential supply of men who will desire to emigrate to this country and who will do so unless prevented.

Federal Electrical Railway Commission Report

Recommends control of service and rate, economical operation, improved equipment, expansion, fair profits, elimination of excessive assessments, regulation of competing automobile service, arbitration of labor disputes, reduction of capitalization, and private ownership.

The Federal Electric Railway Commission, appointed by President Wilson, May 31st, 1919, to investigate the street railway situation is composed of eight prominent men representing the principal interests directly involved, viz:

Charles E. Elmquist, president and general solicitor of the National Association of Railway & Utilities Commissioners.

Edwin W. Sweet, Assistant Secretary of Commerce, representing the Department of Commerce.

Philip R. Gadsdon, representing the American Electric Railway Assocition.

Royal Meeker, Commissioner of Labor Statistics, Department of Labor, representing that Department.

Louis B. Wehle, general counsel of the War Finance Corporation, representing the Treasury Department.

Charles W. Beall, of Harris, Forbes & Company, New York, bankers, representing the Investment Bankers' Association of America.

William D. Mahon, president of Amalgamated Association of Street & Electric Railway Employees of America, representing that association.

George L. Baker, Mayor of Portland, Oregon, representing the American Cities' League of Mayors.

Their report made public late in August contained the following conclusions and recommendations:

1. The electric railway furnishing transportation upon rails is an essential public utility, and

should have the sympathetic understanding and co-operation of the public if it is to continue to perform a useful public service.

2. The electric railway has been, and will continue to be, a public utility, subject to public control as to the extent and character of the service it renders, and as to the rates it charges for such service.

3. It is of the highest importance that both the total cost of the service and the cost to the individuals who use it shall be kept as low as possible without injustice to those who take part in producing it.

4. The electric railway industry as it now exists, is without financial credit, and is not properly performing its public function.

5. This condition is the result of early financial mismanagement and economic causes, accentuated by existing high price levels of labor and materials, and of the failure of the uniform unit fare of five cents, prescribed either by statute or by local franchise ordinances or contracts to provide the necessary revenues to pay operating costs and to maintain the property upon a reasonable basis.

6. The industry can be restored to a normal basis only by the introduction of economies in operation, improving its tracks, equipment and service, and securing a reasonable return upon the fair value of its property used in the public service when honestly and effieciently managed.

7. The electric railways must expand to meet the growing needs of their communities; therefore, the first essential is to restore credit in order to obtain necessary new capital for the extension and improvement of service.

8. Restoration of credit involves a readjustment of relations which will remove public antagonism, provide public co-operation, and insure to the investor the intergrity of this investment and a fair rate of return thereon.

9. Effective public co-operatoin should be exercised by eliminating, in so far as it is practicable, special assessments for sprinkling, paving, and for the construction and maintenance of bridges which are used by the public for highway purposes.

10. Extensions into new territory resulting in special benefits to the properity in that vicinity should be paid for by assessments on such property in proportion to the benefits received, and that the amount of such assessments should not be added to the physical value of the corporate property.

11. The great increase in the use of private automobiles, the jitney and motor buses, has introduced a serious, although not a fatal, competition to the electric railway. These forms of public motor conveyance when operated as public carriers, should properly be subject to equivalent regulatory provisions.

12. The full co-operation of labor is essential to the highest prosperity and the usefulness of the industry. The employees engaged in this occupation should have a living wage and humane hours of labor and working conditions. They should have the right to deal collectively with their employers, through committees or representatives of their own selection. All labor disputes should be settled voluntarily or by arbitration, and the award of such a board should be final and binding upon both parties. It is intolerable that the transportation service of a city should be subject to occasional paralysis, whether by strikes or by lockouts.

13. A private industry should not be subsidized by public funds, unless it is imperatively necessary for the preservation of an essential service, and then only as an emergency measure.

14. Unless the usefulness of the electric railways is to be sacrificed, public control must be flexible enough to enable them to secure sufficient revenues to pay the entire cost of the service rendered, including the necessary cost of both capital and labor.

15. There can be no satisfactory solution of the electric railway problem which does not include the fair valuation of the property employed in the public service, and where that is done, the companies should voluntarily reduce any excessive capitalization to the basis of such value.

16. There is no insuperable objection to a large, wideawake city having exclusive jurisdiction over the rates and services of public utilities.

17. The necessity for scientific and successful regulation of systems, whether large or small, and especially those which operate through several cities and villages and in rural territory, leads to the conclusion that local regulation should generally be subject to the superior authority of the State, whether as a matter of original jurisdiction or through the medium of appeal.

18. Cost-of-service contracts are in the experimental stage, but where tried, they seem to have secured a fair return upon capital, established credit and effected reasonably satisfactory public service. Such contracts may safely be entered into where the public right eventually to acquire the property is safeguarded.

19. The right of the public to own and operate public utilities should be recognized, and legal obstacles in the way of its exercise should be removed.

20. While eventually it might become expedient for the public to own and operate electric railways, there is nothing in the experience thus far obtained in this country which will justify the assertion that it will result in better or cheaper service than privately operated utilities could afford if properly regulated.

21. Public ownership and operation of local transportation systems, whether or not it be considered ultimately desirable, is now, because of constitutional and statutory prohibitions, financial and legal obstacles, the present degree of responsibility of our local governments, and the state of public opinion, practicable in so few instances, that private ownership and operation must as a general rule be continued for an extended period.

22. If the reforms incident to public regulation which we suggest in this report should not result in making private ownership satisfactory to the public, such reforms should at least enable public ownership to be established upon a just and equitable basis.

Selecting Compound Meters

The Hartford Water Department uses compound meters for all sizes over two-inch, and installs different makes, each where its peculiarities best meet the conditions of the service in question. The peculiarities of the several makes are studied, as described by J. E. Garratt, engineer of the Department, in this article.

The Board of Water Commissioners of Hartford, Conn., uses compound meters on a considerable number of services, and has investigated quite thoroughly the characteristics of each of the compound meters on the market and the conditions for which each is best suited. Some of the conclusions and conditions were described by J. E. Garratt, office engineer of the board, in a paper before the N. E. Water Works Association, from which the following is abstracted:

Compound meters are used in Hartford almost exclusively where the size exceeds 2 inches. In some cases, instead of using a compound meter, a compounding valve is purchased and used in connection with a large and small meter of ordinary make, giving such combinations as a Hersy-Crest compound meter, a Nilo-Thompson, etc. Of the several compound meters each has its own peculiarities. One may have the largest capacity of a given size, but also the greatest weight to be handled and the largest space for setting. Another may require a straight run of pipe on the inlet end in order that it may register properly; a third may be light, compact, well made and easily handled by one man, yet be of too small capacity for compound meter service. Of two having equal capacity and dependability, one may be heavier to handle but take up less space than the other; or it may be possible to dismember and enter one of them through a small opening through which the other cannot be entered.

In selecting compound meters, the Hartford Water Department considers the following points:

1. Loss of pressure at various rates, low as well as high.
2. Accuracy of registration, with special regard to the accuracy at the point where the flow begins to pass through the large meter.
3. Effect of entrance disturbances on the accuracy of registration.

In selecting, from the several kinds which it purchases, the particular meter for a given installation, the department considers further the following points:

1. Loss of pressure at the rates expected on the installation.
2. Rate at which compound valves begin to open with relation to possible uses at that point.
3. Weight in connection with meter setting.
4. Space occupied, if available space for setting meter is small.

The most serious consideration is the effect of angles or bends in the pipe on the accuracy of registration. Several makes of compound meters are in no way affected by bends in the entrance pipe, but one or two require a straight entrance run of pipe of the same size as the meter without valves or other disturbing elements. One meter, for instance, showed the percent of flow registered to vary, when there was an elbow to the left in the inlet pipe, 7.4 per cent when there was 1 foot of straight inlet, 1.5 per cent where there was 2 feet, 4.6 per cent when there was 3 feet, and 2.4 per cent when there was 4½ feet. The same meter showed a change in percent of registration of about 2 per cent when a valve on the inlet side was three-quarters closed.

In all compound meters, at that rate of flow where the weighted check valve begins to open, the percentage of registration is low, although the sag in the percentage curve is much greater in some makes than in others. Also, the loss in pressure increases at this point, being as much as 10, 15 or even 20 pounds in some meters. One meter, for instance, showed 15 pounds pressure just before the check valves opened, the pressure dropping immediately and being only 7 pounds when the quantity passed was three times as great as that when the pressure was maximum.

There are sometimes such conditions of use that the bulk of the flow is about at the rate where the percentage of registration is low. An effort should be made in such a case to select a make of compound meter which changes from small to large meter at some other rate of flow. Mr. Garratt cited an instance in which the architect of a building with a restaurant on the top floor insisted on a 3-inch compound meter whose pressure loss mounted rapidly to 10 pounds at a rate of about 1.5 cubic feet per minute and then dropped back quickly to 2½ pounds. This building used water at a rate close to 1.5 cubic feet, and as the building was high and the pressure in the mains low at this point, it was difficult to obtain supply at the top of the building; but had a 2-inch disc meter been installed, as the department had recommended, the loss of pressure would have been less than 1 pound.

At least one type of compound meter has adjustable weights on the compounding valve so that it can be made to open at any desired rate of flow. Before this was realized by the department, it had installed such a compounding valve on a 4-inch line supplying a power station. Previous to this, a compound meter had been installed on this line and the disc of the small by-pass meter had broken and been replaced three times.

Investigation showed that the small meter had passed 600,000 cubic feet of water and the large 4-inch meter slightly less than this amount. This was remedied by removing some of the weight from the compounding valve.

Sellers of compound meters place great emphasis on the great reduction such meters make in the amount of water which passes the meter without being registered. So far the Hartford department has not been able to get many figures on this. The compound meters have been principally new installations and the few which they have compounded themselves have been on factories and power stations where the use of water was very erratic and variable.

The department makes yearly tests of all large meters, in place, testing them on small flows as well as on large, and so keeps them in good shape.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

Installing Pipes Through Railroad Embankments

In the construction, maintenance and repair of water supply and sewer systems and electric conduits, it sometimes happens to be necessary to carry pipes under railroad lines built on an embankment. Usually the railroads, whether steam or electric, have practically continuous traffic, which is especially heavy and high-speed for steam roads, so that any interruption or retarding of service, or any operations that might possibly jeopardize the road-bed, are strongly opposed and usually absolutely prohibited, thus making it impracticable to carry the pipes through the embankment by open cut in the same manner that they can be carried in other places or by supporting the tracks on overhead bridges or by diverting them temporarily on by-passes, as can often be done with street and highway traffic.

Either the contractor must find some method of construction that is unobjectionable to the railroad or sometimes, at great expense and delay, he can have the crossing made by the railroad authorities, an alternative that is generally very costly and troublesome.

The obvious method by tunneling is likely to cause troublesome settlement of the track and possibly seriously endanger traffic, because it is very difficult to tunnel close to the surface without bleeding, especially in filled or made soil and where, as in this case, it is subject to heavy loads and vibrations. In addition, the embankment is almost always of minimum width and with slopes approximating the angle of stability of the material, so that little factor of safety exists.

Even if tunneling methods were acceptable to the railroad companies, few general contractors have competent tunneling workmen or superintendents available and should hesitate about undertaking such critical work, therefore, tunneling may well be eliminated in ordinary cases.

The question then becomes, in most cases, how to install water or sewer pipes from 4 to 36 inches in diameter and from, say, 30 to 150 feet long, at elevations 5 feet or more below rail level and not far below the original surface of the ground.

JACKING SMALL PIPES

The method of jacking has been successfully used for the installation of pipes without previous excavation through railroad embankments up to 100 feet or more in thickness. For pipes of small diameter or short length, this is a very simple and easy operation involving simply the provision of a solid bulkhead or other support to resist the horizontal reaction of a jack sufficiently powerful to drive the pipe.

The exacavation is stopped at the point where its farther progress might possibly endanger the embankment; the pipe is carefully aligned both horizontally and vertically, and the jack inserted between its outer end and a bulkhead or reaction support. Provision must be made to hold the rear end of the pipe in a cradle with devices to keep it in place. Blocking or struts varying in length by the stroke of the jack, should be provided and as fast as the jack drives the pipe for its full stroke these fillers should be successively inserted until the pipe has been driven the full pipe length; then another pipe is jointed to it and both together are driven forward as before until the forward end of the first pipe emerges on the opposite side of the ambankment.

For screwed pipe of small diameter the work should be easy and rapid if rocks, timber or other obstacles are not encountered and these are seldom met with in ordinary railroad embankments. For a stone embankment, of course, this method is not applicable.

For pipes up to 6 inches in diameter better progress will probably be attained by providing a conical pilot or driving head for the forward end of the pipe, and the force required for driving would be approximately equivalent to the friction on the pipe, and up to lengths of 100 feet it would probably be within the limits of a powerful screw or ratchet jack. If one of these jacks proves insufficient, it could easily be supplemented by one or more additional jacks arranged symmetrically about the center line of the pipe and bearing against a jacking piece attached successively to each additional length of pipe jointed on.

The skin friction may vary from 50 pounds or less up to several hundred pounds per square foot of exterior surface, according to the depth below the surface, the character of material and, if below ground water level, the amount of water encountered. It is likely to be less in the embankment proper than if the pipe is being driven through the natural soil below the base of the embankment. Some idea as to whether the soil is loose and can be penetrated easily or not may be gained by inspection and by sounding with a small steel rod driven with sledge hammers, but it is impossible to calculate accurately in advance how hard the driving will be, and it is best to be assured of additional or more powerful jacks if the first one does not suffice. For loads of more than 25 tons, hydraulic jacks, which can be had up to 100 tons capacity or even more, should be used. Where one jack can be made to suffice, it is much better to use it placed in the axis of the pipe than to endeavor to use several jacks. It is likely to be difficult to locate more than two jacks for convenient operation or to drive them with exact regularity and synchronization, thus making it more difficult to maintain the alignment of the pipe.

LARGE DIAMETER PIPES

For pipes more than 6 inches in diameter it is possible to omit the pilot and to drive the pipe with the front end open, thus permitting, every time the jack is removed, the insertion of a long-handled spoon, auger, or other device to loosen or remove the earth in front of the pipe, thus facilitating the driving. With pipes of 30-inch diameter it is possible for the jacks to be arranged to bear on collars or suitable frames attached to the rear end and permitting the free entrance into the pipe of a laborer who can crawl through and continuously excavate the material in advance, provided it is of such character that there is no indication of bleeding or settlement of the track above.

If the pipe is cast iron with short lengths and hub and spigot joints, the latter will create an excessive resistance to jacking and probably, if not corrected, will make it impracticable except for short pipes of small diameter. However, if such pipe is jacketed with wood staves or some other device that provides a uniform diameter and smooth exterior surface, the resistance to jacking will be greatly reduced to correspond with that of screwed or riveted steel pipe.

For embankments not more than 10 or 15 feet high, pipes can usually be driven under two or three tracks, but if embankments are much higher or the number of tracks much greater, the width at the base is likely to be so much increased that the difficulty of driving becomes excessive. This may be somewhat reduced in the case of high embankments by trenching into the bottom of the embankment as far as permissible on both sides, great care being taken to thoroughly sheet and brace both the sides and the forward end of the excavations so that no settlement or displacement of the embankment can occur. In this way driving may be eliminated at the toes of the embankment and be necessary only directly under and a little beyond the tracks.

DRIVING FROM OPPOSITE SIDES

Pipe large enough for men to excavate from the interior may be driven from both sides of the embankment to meet at the center, thus reducing the resistance for each section and practically doubling the possible length across it, but except for culverts or similar structures, this method would be subject to objections arising from the difficulty in making a joint between the two sections that would be satisfactory to the engineer, and the difficulty of driving with sufficient accuracy to insure a perfect meeting underneath the embankment would require extreme delicacy and precision of measurements and adjustments and very great skill in the execution of the work and might quite likely involve the necessity of a special joint that might require enlarged excavation where the pipes met.

Driving from opposite sides of the embankment might be considerably facilitated by driving a preliminary pilot rod or pipe of small diameter that could be forced through the embankment from side to side in the axis of the required location. This pilot could then be used as a center of the alignment, on which the two sections of large pipe could be threaded with suitable bearings and thus have their directions accurately controlled until they met at the center of the embankment where, however, it would be necessary to have some kind of joint that could be made from within the pipe, obviously a difficult one to design and construct.

SUPPORTING TRACKS

Where the difficulties or dimensions are very great, the jacking method, which is limited in application, must be dispensed with and special provisons made either for tunneling under expert supervision or for absolute support of the track while either tunneling or trench work is carried on under it; methods which may be indispensible but which would be costly.

This can be accomplished by driving piles on both sides of the pipe line parallel to it, and supporting on them girders that form regular bridge spans carrying the track over the pipe. The railroad company is likely to insist on performing this construction in a manner designed by its own engineer and executing it with its own force at such time as is most convenient for it, after which the contractor will be permitted to make the necessary excavation, install his pipe and pay the railroad's bill, a contingency which should be allowed for in the estimates unless he is assured that the jacking method will be practicable and acceptable.

Recent Legal Decisions

WHETHER ADDITIONAL MATERIAL PAYABLE FOR AT CONTRACT PRICE OR ON QUANTUM MERUIT

A contractor contracted to furnish material and build a bridge in accordance with certain plans and specifications, payment to be made on the basis of the weight of material used. On a subsequent change of the plans, requiring a materially longer bridge and more material, but of the same kind, the contractor without objection proceeded and built the bridge. In an action for the balance due it was held, Keystone Structural Co. v Live-Belt Co., 265 Fed. 320, that the price was to be measured by the contract, and not, as claimed by the contractor, on quantum meruit. The doctrine that a change in the subject-matter of the contract, as the common phrase expresses it, "breaks the contract," is an accepted, because necessary, doctrine, when the principle on which it rests applies. Whatever work is done, or materials are supplied, if not done or supplied at an agreed price, must necessarily be priced on a quantum meruit. The doctrine does not apply, however, when the subject-matter of the contract can be found in what is performed, and the change is only by way of addition of other work and material. The familiar cases of contract price and "extras" arise from this. The "extras" only are the subject of the implied contract, and necessarily so, because the contract price for one thing cannot measure a different thing. When, however, the change is only by way of additional units, the contract price governs. There is, of course, no obligation to supply more than is called for by the contract; but, if what is supplied is nothing more than additional units of the things contracted for, the fair implication is the parties have agreed to change the subject-matter of the contract, or there is an implied agreement on the same price. If a contractor is unwilling to exceed his contract obligation on the contract terms, he has only to say so; but if he is willing he may, and his doing it justifies the finding of his agreement to do so. Of course, if the contract price cannot be applied to what is done beyond the contract, it is necessary, as well as equitable, to resort to an implied quantum meruit contract.

RIGHTS OF SURETY AND ASSIGNEE OF CONTRACTOR IN MONEY RETAINED

A construction contract authorized the board of road commissioners to retain 15 per cent of the monthly estimates, and the surety on the contract was subrogated to and had assigned to it the rights of the board. It is held, O'Neil Engineering Co., v. First Nat. Bank of Paris (Tex.) 222 S. W. 1091, that the contractor's assignment of the remaining 85 per cent. gave its assignee rights superior to the board and surety so long as the contractor was carrying on the work and not in default. The contract provided that the 15 per cent. retained should be paid on or before the fourth Monday of the month following that in which the work was performed. The warrant for the work done in the previous month, although approved on the 4th of the month, had not been delivered on the 8th of the month, when the contractor defaulted. A bank which had an assignment of warrants to become due demanded payment. It is held that the board was warranted in retaining the amount because of default, so that the rights of the surety, to which had been assigned all sums retained, etc., were superior to those of the bank.

PART OF PAYMENT TO BECOME DUE BY CITY TO CONTRACTOR HELD ASSIGNABLE

In an action against a contractor by the assignee of part of a payment to become due by a city on performance of a contract, the New York Court of Appeals holds, Hinkle Iron Co. v. Kohn, 128 N. E. 113, that the creation of ownership of so much of the fund as was assigned was not dependent upon the consent of the city to, or the filing of, the assignment. Nor was it affected by the fact that the debt was to be created and the payment was to become due, or that the assignment was of the part only of the designated payment. The test was whether or not the assignment made an appropriation of the fund, so that the debtor would be justified in paying the debt or the assigned part to the person claiming to be the assignee. The assignment satisfied the test. The contractor received the entire sum of the payment from the city, which largely exceeded the sum assigned to the plaintiff, and deposited the sum to its credit in a bank. After payment, the sum was in the contractor's possession as a special deposit or bailment for the plaintiff's benefit. The contractor could not lawfully appropriate it to another purpose. It could not convert or misappropriate it, without making itself liable to the plaintiff for the amount converted. The plaintiff was therefore entitled to recovery of the sum assigned.

WETTING DOWN CURB EXTENDED TIME FOR FILING LIEN NOTICES

An appeal by the sureties on a contractor's bond under the California Vrooman Street Improvement Law, the plaintiff having sued for materials furnished by it for a concrete curb, the principal question was whether the lien notices filed with the street superintendent were filed within 30 days from the time the improvement was completed. The contract required wetting down the curb for seven days. The work was to be done to the satisfaction of the superintendent, who required wetting down for ten days, which the contractor did under his protest that the work for the last three days was, nevertheless, done under the contract. It was held, Barr Lumber Co. v. Joy Const. Co. (Cal.), 190 Pac. 844, that the time for filing lien notices dated from the completion of the ten days.

NEWS OF THE SOCIETIES

Oct. 12-14—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention, St. Louis. Secretary, Charles Carroll Brown, 401 Lincoln Avenue, Valparaiso, Ind.

October 13-15—AMERICAN CIVIC ASSOCIATION. Annual convention, Amherst, Mass. Secretary, E. F. Marshall, Union Trust Bldg., Washington, D. C.

October 16-19—AMERICAN COUNTRY LIFE ASSOCIATION. Annual conference, Springfield, Mass. President, Kenyon, L. Butterfield, Amherst, Mass.

Oct. 19-22—INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. 25th annual convention, New Orleans, La. Secretary, C. R. George, Houston, Texas.

OCT. 26-28—AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION. Convention at tlanta, Ga. Headquarters, Chicago.

November 12—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Second Fall meeting, Chicago. Sec., 33 W. 39th St., New York.

Nov. 15-17—CITY MANAGERS' ASSOCIATION. Annual convention at Cincinnati, O. Executive Secretary, Harrison G. Otis, 812 Tribune Bldg., New York City.

Dec. 7-10—AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual meeting, New York. Secretary, 29 W. 39th St., New York City.

Jan. 25-27, 1921—THE AMERICAN WOOD PRESERVERS ASSOCIATION. Place of meeting to be announced later.

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS

The twenty-sixth annual convention will be held at the Planters Hotel, St. Louis, Mo., October 12, 13, 14, 15, 1920.

The program commences with a golf tournament on the municipal course at 2:00 p. m., October 11.

At 8:00 p. m. there is a preliminary joint meeting of executive committee and finance committee and meetings of committees on specifications.

OCTOBER 12

9:00 a. m.—Registration and executive committee meeting. 9:00 to 11:00 a. m.—Meetings of committees on specifications as follows: 9:00—Bituminous Macadam, Bituminous Concrete and Asphalt Block Pavements, Brick Pavements, Stone Block Pavements. 9:30—Sheet Asphalt Pavements, Cement Concrete Pavements, Wood Block Pavements. 10:00—Broken Stone and Gravel Roads, Sidewalks and Curbs, Sewers. 10:30—Foundations for Pavements.

11:00 a. m.—Opening of the convention. Address of Welcome: Mayor Henry W. Kiel; Response: Col. R. Keith Compton, First Vice-President. President's Address: George H. Norton. Report of Executive Committee. Report of Secretary. Report of Treasurer. Report of Finance Committee. Selection of committees on nominations, place of meeting and resolutions. Introduction of proposed amendments to constitution, and other new business. Report of Committee on Public Markets. Report of Committee on Water Works and Water Supply. Report of Committee on Municipal Legislation and Finance. Report of Committee on Street Cleaning, Refuse Disposal and Snow Removal. Methods of Snow Disposal.

12:30 p. m.—Round table discussions at lunch on enlargement of society's activities; co-operation with national highway council; with American engineering standards committee; extension of standard specifications to other subjects; increase in number of committees, e. g., street-car track construction, pavement maintenance, road and pavement sub-grade, pavement foundations; sub-division of existing committees, etc.

Relations of associate members to committees, to membership on committees, to privileges of the floor, etc. Financial outlook of the society under the increased cost of living: how shall increased expense be met. Oiling of unimproved streets, resurfacing of old brick pavements; rejuvenating of wood-block pavements; excavations for surface cuts in pavements. Zoning; general city planning; city lighting.

The plan, subject to change, is for groups interested in certain subjects to gather about assigned tables, each of which will be in charge of a chairman. To make this plan successful each member must, on registering, designate the subject in which he is specially interested, that the tables may be properly assigned and filled.

Geo. W. Tillson, E. R. Dutton, Harland Bartholomew, Geo. H. Norton, R. K. Compton, E. S. Rankin, W. W. Horner are some of those selected as leaders. If the round table on Tuesday noon promises success, others will be arranged for at breakfast at 8:00 promptly each morning.

TUESDAY AFTERNOON

Report of Committee on Street Lighting. Street Illumination—Hugo Wurdack, President of National Light and Development Co., St. Louis, Mo. Street Lighting in St. Louis—Ralph Toensfeldt, Engineer Department of Public Utilities, St. Louis, Mo. Street Lighting and Traffic Accidents—Ward Harrison, Illuminating Engineer, National Lamp Works, Cleveland, Ohio. The St. Louis Water Works—E. E. Wall, Water Commissioner, St. Louis, Mo.

Report of Committee on Fire Prevention. Fire Prevention and Fire Fighting—Clarence E. Ridley, City Engineer, Port Arthur, Tex. Valley Forge—S. Cameron Corson, Borough Engineer, Norristown, Pa. (Illustrated). Municipal Finance. Louis Nolte, City Controller, St. Louis, Mo.

8:30 p. m.—Reception in the parlors of the Planters Hotel followed by dancing.

OCTOBER 13—MORNING

Report of Committee on Sewerage and Sanitation. The Work of the Sanitary District of Chicago, Past, Present and Future, from a Sanitary Standpoint—Langdon Pearse, Sanitary Engineer, Chicago, Ill. The St. Louis Sewer System—W. W. Horner, Chief Engineer Paving and Sewerage, St. Louis, Mo. (Illustrated). Unusual Structures in the St. Louis Sewer System—Guy Brown, Engineer of Sewer Design, St. Louis, Mo. Grit Chambers for Sewage Disposal Works—George B. Gascoigne, Sanitary Engineer, Cleveland, Ohio. The Present Status of the Activated Sludge Sewage Disposal Process—Edward Bartow, Director of State Water Survey, Urbana, Ill. The Disposal of Trade Wastes—Robert Spurr Weston, Consulting Sanitary Engineer, Boston, Mass. The Miles-Acid Process on Tannery Sewage Waste—E. S. Dorr, Engineer in Charge of Special Work, Sewer Department, Boston, Mass (In Advance Papers). Ten Years' Operation of Municipal Garbage Reduction Works—Walter B. Bee, Superintendent of Municipal Reduction Works, Columbus, Ohio.

2:00 p. m.—Automobile ride, visiting the Municipal Building Group and passing over the most recent paving projects under construction en route to the great industrial district developed during the past three years. Later visiting Washington University and Forest Park, where a stop will be made for luncheon and an opportunity given to see the St. Louis Zoo, the Municipal Art Museum and the Municipal Theater. The ride will be continued over the Railroad Section to Shaw's Garden, the south-side residence district, and Reservoir Park.

8:00 p. m.—Election of officers and selection of place of meeting. Report of Committee on City Planning—Harland Bartholomew, Chairman, Engineer of City Plan Commission, St. Louis, Mo. The St. Louis City Plan—E. R. Kinsey, President of Board of Public Service, St. Louis, Mo. The Zoning Plan Recently Adopted for Washington, D. C.—Harland Bartholomew, Engineer City Plan Commission, St. Louis, Mo. Pittsburgh Problems in City Planning, Due to Rugged Topography (Illustrated)—N. S. Sprague, Chief Engineer, Bureau of Engineering, Pittsburgh, Pa. (Abstract in Advance Papers.) Highways for Traffic in Town and Country—Nelson P. Lewis, Chief Engineer, Board of Estimate and Apportionment, New York City. The Construction of Municipal Bridges and Buildings in St. Louis—L. R. Bowen, Engineer of Bridges and Buildings, St. Louis, Mo. Suggestions from European Practice in Municipal Improvements—George B. Ford, Director City Planning Department, Technical Advisory Corporation, New York City (Illustrated). The Relation of Zoning to the Work of the City Engineer—E. S. Rankin, Engineer Bureau of Sewers, Newark, N. J.

OCTOBER 14—MORNING

Report of Committee on Street Paving, Sidewalk and Street Design. Producing and Refining of Asphalt—Herbert Spencer, Engineer Standard Oil Company of New Jersey, New York City (Illustrated). (Abstract in Advance Papers.) Asphaltic Pavement Construction on Illinois State Highway and Chicago Boulevard Link (Illustrated)—John B. Hittell, District Engineer, The Asphalt Association, Chicago, Ill. The Elimination of Unnecessary Testing from Asphalt Specifications—R. R. Barrett, Engineer The Texas Company, New York City. Asphalt Block Pavements—P. L. Thompson, Hastings Pavement Co., New York (In Advance Papers). The Present Status of Macadam Base for Bituminous Pavements—Julius Adler, Technical Engineer The Atlantic Refining Co., Philadelphia, Pa. (Abstract in Advance Papers). Wood Block Paving—Herman Von Schrenk, Consulting Engineer, St. Louis, Mo. Concrete for Municipal Paving—Col. H. C. Boyden, The Portland Cement Association, Chicago, Ill. Paving Brick and Brick Pavements, Special Features—J. C. Travilla, Consulting Engineer, St. Louis, Mo. Brick vs. Block for City Street Paving—S. Cameron Corson, Borough Engineer, Norristown, Pa. (In Advance Papers). Gravel: A Plea for Common-Sense Specifications—Wallace F. Purrington, Chemist and Testing Engineer State Highway Department, Concord, N. H. (In Advance Papers). Specifications and Tests for Road Gravel—F. H. Jackson, Testing Engineer U. S. Bureau of Public Roads, Washington, D. C. The Protection of Gravel Roads by Surface Treatments—Philip P. Sharples, Manager General Tarvia Department, The Barrett Company, New York City.

12:30 p. m.—Round table discussion at lunch. Subjects listed under Tuesday Noon may be discussed or proposed changes in specifications may be taken up. Asphalt, brick, cement-concrete, stone-block, wood-block, sidewalks and curbs, sewers, foundations of pavements, treatment of pavement sub-grade.

THURSDAY AFTERNOON

Reports of Committees on Specifications. Action on proposed amendments to the constitution. Report of Committee on Resolutions.

8:30 p. m.—Smoker and the morality play, "Every Engineer." A unique production by the "Engineer Players," a group of members of the Engineers' Club of St. Louis, who do not take themselves too seriously but who "point a moral and adorn a tale." An informal evening for delegates and their ladies, in charge of the Engineers' Club and the Ladies' Committee.

OCTOBER 15—MORNING

Report of Committee on Traffic and Transportation. Relation of the Proposed Uniform Vehicle Law to Municipal Traffic Regulations—Henry G. Shirley, Secretary of Federal Highway Council, Washington, D. C. Pavement Foundations as a Factor in Economic Transportation—Robert C. Barnett, Consulting Civil Engineer, Kansas City, Mo. Width of Roadways for Different Classes of Streets—Robert Hoffmann, Commissioner, Division of Engineering and Construction, Department of Public Service, Cleveland, Ohio. Report of Committee on Standard Tests for Bituminous Materials. Housing—Nelson Cunliff, Secretary and Manager, Home and Housing Association, St. Louis, Mo.

12:30 p. m.—Round table discussions will be continued at lunch.

2:00 p. m.—There will be a special trip on the steamer *Erastus Wells*, the harbor boat of the city of St. Louis, along the northern water front, stopping at the new St. Louis Municipal Docks, a large portion of which structure is now in full operation, while other units are still under construction, and going to the St. Louis Water Works at the Chain of Rocks, and return.

SECTIONS OF AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

CINCINNATI

September 9, 1920, Assembly Hall, Union Gas & Electric Company. The speaker of the evening was Mr. P. M. Lincoln, a past-president of the Institute, who gave a very interesting talk on the history of the Institute. The second part of Mr. Lincoln's program was on the electrification of steam roads.

DENVER

August 19, 1920, Savoy Hotel. This special meeting was called in honor of Secretary Hutchinson, who talked to the members about Institute affairs. Mr. H. B. Dwight told something of his experiences at the annual convention.

UNIVERSITY OF CALIFORNIA

August 25, 1920. Talk on "Westinghouse Junior Courses" by Messrs. Andrews, Baston and Cates.

UTAH

August 16, 1920, Commercial Club. Speaker, Mr. F. L. Hutchinson, secretary of the Institute. Subject, "Institute Activities."

SECTIONS OF AMERICAN SOCIETY OF CIVIL ENGINEERS

TEXAS SECTION

At the fall meeting in Austin, October 20-21, papers will be presented on "Concrete Construction," by G. G. Wickline, bridge engineer, State Highway Department; "Probable Flood Discharge of a 48 Square Mill Area Near Paris, Tex.," by Major John B. Hawley, consulting engineer, Fort Worth; "Early Irrigation in Texas," by E. P. Arneson, consulting engineer, San Antonio; "Manufacture of Pipe and Clay Products Used in Sewer Construction," by M. C. Erwin, sewer engineer, city of San Antonio; "Contributing Factors to the Increasing Cost of Road Building," by T. H. Webb, State Highway Department; "Presentation of and Discussion on 'Standard Form of Contract with Arbitration Clause,'" by Major John B. Hawley; "Organization and Progress on the Dallas Levee District," by E. N. Noyes, district engineer and secretary-treasurer of the section.

PHILADELPHIA SECTION

At the meeting of September 13, the Philadelphia Section voted endorsement of amendments "A," "B," and "C" to the constitution, thus confirming the previous action of their Committee on Development.

ILLINOIS SECTION

At a Chicago meeting, September 17, the proposed amendments to the constitution were vigorously discussed and it was unanimously resolved to reject amendments "A," "F," and "G."

AMERICAN CHEMICAL SOCIETY

At the semi-annual meetings in Chicago, September 6-10, the Council decided not to affiliate with the Federated American Engineering Societies, believing it would be more desirable to promote co-operation upon an independent basis and thus avoid subordination of chemical activity to strictly engineering service.

The council also urged local sections to refrain from affiliating with other local engineering and technical societies in state or district federations.

PERSONALS

Schenk, T. M., district engineer, Public Works Department of Canada, Halifax, Nova Scotia, died at Montreal September 4.

Hardy, A. W., has been appointed resident engineer of the Minco-Union City bridge, Oklahoma.

Davis, J. C., has been appointed testing engineer for the State Highwav Department, Oklahoma.

Jervey, Col. J. P., Corps of Engineers, U. S. A., in charge of the Baltimore district, has made application for retirement.

Buswell, Dr. A. M., associate professor of engineering, Columbia University, has been appointed director of the Illinois State Water Survey.

Allen, J. P., recently U. S. assistant district engineer, Charleston, S. C., has opened an engineering office at Charleston.

Parker, J. L., has been made special bridge engineer of the South Carolina State Highway Commission.

Seaton, R. A., has been appointed dean of engineering at Kansas State Agritultural College.

Fuller, C. H. R., has been appointed city engineer of Chatham, Ont.

Powell, Major, R. G., has been made assistant to Gen. Harry Taylor in charge of the river and harbor work of the Corps of Engineers.

Walton, Col. E. G., Chamberlain, Lt. Col. F. G. and Fredntll, Lt. Col. I. L., have been appointed officers in charge of the district headquarters of Construction Service in Washington, D. C., in San Antonio, and in San Francisco, respectively.

Trimble, E. E., has been appointed as full-time secretary of the Nebraska State Assemble of the American Association of Engineers with headquarters in Omaha.

Butler, Drury, has been appointed engineer of Sacramento County, Cal.

Connor, F. G., has been reappointed superintendent of water works Sioux Falls, S. Dak. ,

Wedt, Professor Wylie, has been appointed professor of civil engineering at the South Dakota School of Mines.

Howe, S. B., has been reappointed city engineer of Sioux Falls, S. Dak.

Largewell, A. C., has been made engineer of Shawnee County, Kan., head quarters at Topeka.

Wright, P. F., draftsman of the U. S. Engineer's Office, Charleston has been transferred to the office of the District Engineer, Baltimore, Maryland.

Blomquist, H. M., has been appointed superintendent of the Cedar Rapids Iowa, water-works system.

Bean, L. V., has been appointed chief engineer of roadways for the Georgia, Florida & Alabama Railroad.

Williams, G. M., has been appointed professor of civil engineering University of Saskatchewan.

PUBLIC WORKS.

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 49 FLORAL PARK, OCTOBER 16, 1920 No. 16

Paving North Broad Street, Philadelphia

Sheet asphalt laid in 45-foot center strip while sewers were being built on both sides, after which the surface above them was paved by subsequent operations.

During the summer just past, a sheet asphalt pavement was laid over about 1¼ miles of North Broad street, Philadelphia, where the roadway has a total width of 69 feet and where there are two trolley tracks. The work was done under the direction of the Bureau of Highways, Department of Public Works, Fred C. Dunlap, chief of bureau, and Chas. F. Puff, Jr., principal assistant engineer in charge of construction. The work was executed by the Barber Asphalt Company for a contract price of about $201,000.

The work involved about 4,000 yards of earth excavation to a maximum depth of 6 feet. The upper 4 feet was removed by a Thew steam shovel and it was completed to sub-grade by a Keystone grader machine.

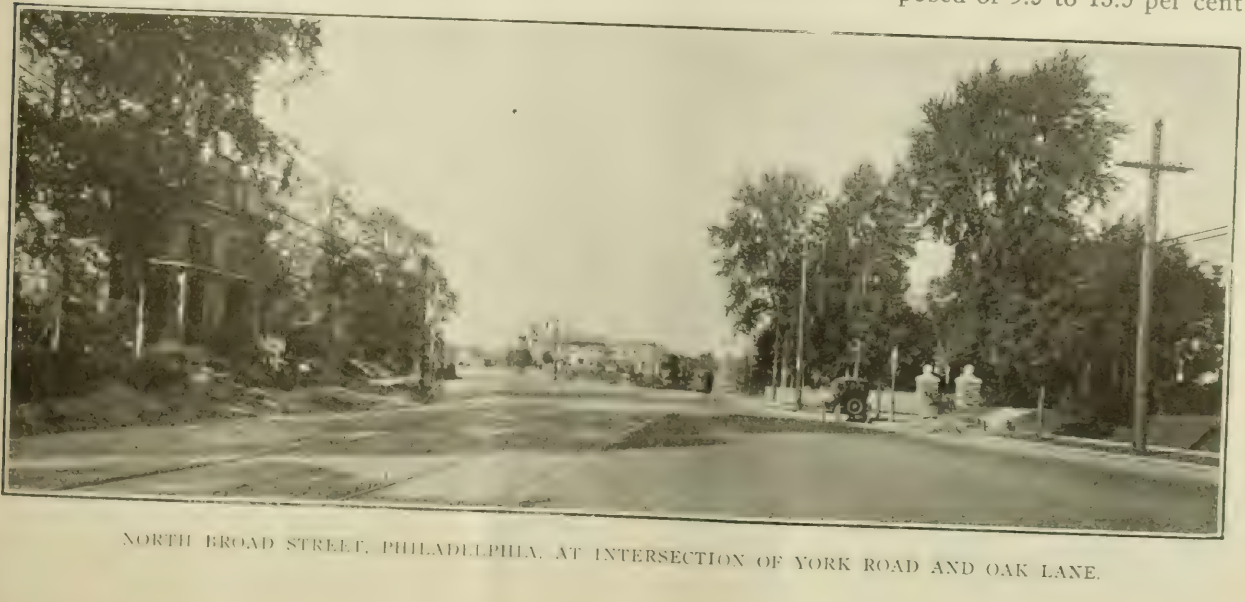
The base course contained about 9,150 cubic yards of 1:3:6 Portland cement concrete, made with graded sand of a maximum size of ¼ inch and graded stones from ¼ to 1½ inches in diameter. It was mixed at the site in one Ransome and two Foote machines, which together yielded an average product of 200 cubic yards per day.

BINDER COURSE

The hot binder mixture was transported a maximum distance of 7½ miles in clean, tight steel carts covered with canvas, deposited at a temperature of 200 to 325 degrees on the carefully cleaned concrete surface, and immediately rolled to a thickness of 1 inch with a 1-ton, a 5-ton and a 7-ton Iroquois Iron Works rollers successively operated, each roller being operated continuously at a rate of not more than 300 square yards per hour and traveling both transversely and longitudinally of the roadway. The rollers were kept moistened with water to prevent adhesion, and great care was taken to deliver the binder in time for it to be rolled and finished on the same day. For a distance of 8 inches around all hydrants, manholes and other structures penetrating the binder, the latter was compacted with hot tampers weighing 25 pounds and having a bearing surface of not more than 48 square inches.

SURFACE COURSE

On the finished binder course there was spread a surface course composed of 9.5 to 13.5 per cent



NORTH BROAD STREET, PHILADELPHIA, AT INTERSECTION OF YORK ROAD AND OAK LANE.

of stone dust passing a No. 200 sieve, 18 to 30 per cent of sand passing a No. 80 sieve, 20 to 50 per cent of sand passing a No. 40 sieve, 8 to 25 per cent of sand passing a No. 10 sieve and a maximum of 10 per cent passing a No. 4 sieve. The sand and asphaltic cement were heated separately to a temperature of 300 degrees Fahrenheit, Portland cement or stone dust added to the hot sand and thoroughly mixed, and the asphaltic cement added and mixed, transported a maximum distance of 7½ miles from the asphalt plant to the work in covered receptacles, poured over the dry, clean surface of the binder at a temperature of 250 to 280 degrees, raked and rolled in the same manner as the binder to a finished thickness of 1½ inches. It was first rolled by a 2½-ton roller giving a compression of approximately 125 pounds per inch width of tread, followed by a roller with 200 pounds per inch, operated equally in longitudinal and transverse directions at the rate of not more than 200 square yards per hour. An area of 8 inches around all structures penetrating the pavement and where it was inaccessible to the rollers was finished with hot 25-pound rammers with a bearing area of not more than 48 square inches. All of the surface was tested by a 10-foot straight-edge. All of the depressions, projections, joints and any honeycomb surfaces were smoothly ironed to grade and finished by Portland cement swept over the entire surface, traffic being prohibited for at least three hours after its completion.

The work was executed by an average force of 45 men and a maximum of 65 men, who completed a maximum of 2,100 square yards in one 8-hour day. One asphalt gang of 15 men and one concrete gang of 22 men were employed besides the excavating men, helpers, etc.

While the 45-foot strip in the middle of the road, including the street-car tracks with granite block pavement, were being laid, a 24-inch brick sewer and a water main were being laid on each side of the road and, after their completion, the paving gangs returned to the starting point and simultaneously paved the two side strips, each 12 feet wide, over the sewers and water mains. At the intersection of Broad street and York road, where there was a diagonal crossing, the two trolley tracks were separated by a 20-foot strip of Filbertine pavement.

SPECIAL TEMPORARY CONSTRUCTION

At the intersection of Broad street with Oak lane (the old New York route), where the road was not legally opened, a satisfactory connection with the intersecting street was made, permitting the new pavement to be continuous and effecting a considerable economy over making the regular construction and subsequently removing and rebuilding it. Here a strip 20 feet wide was built with a foundation of 5 inches of rolled slag, 1½ inches of binder and 1½ inches of surface course, affording about 1,600 square yards of uniform and satisfactory surface at an estimated saving of about $1.50 per square yard.

Casting and Steaming Reinforced Pipe

Ten miles of 5½-foot pipe, costing $1,350,000 when laid, was fabricated and seasoned in the contractor's yard at Transcona, Canada.

The 99-mile aqueduct with a capacity of one hundred million gallons of water daily for the city of Winnipeg, Canada, is built chiefly of horse-shoe-shape concrete conduit, but includes ten miles of reinforced concrete cylindrical pipe 5½ feet in diameter and 8 inches thick, which is subjected to a static working pressure of about 30 pounds per square inch.

The pipe was made in a special casting yard at Transcona by the Canada Lockjoint Pipe Company, Limited, for the general contractor, the Winnipeg Aqueduct Construction Company, which executed the work designed by Consulting Engineer James H. Fuertes.

DESIGN

The pipe was made with a mixture of 700 pounds (3.8 cubic feet) Portland cement to one yard of 1:1½:2½ concrete, using very well graded aggregate and mixed to a jelly-like consistency that easily flowed to place when slightly puddled.

The pipes are reinforced, 2 inches from the outer surface, by spiral coils of ½ to ⅝-inch square steel rods wired to longitudinal rods and enclosing cylindrical reinforcement of heavy woven American Steel & Wire Company's triangular mesh fabric 2 inches from the inner surface of the pipe.

The inner and outer cylindrical surfaces are uniform throughout, the hub and spigot joints being made entirely within the regular thickness of the pipe. Joints were made with 1:1 cement mortar, with crimped copper sleeves providing watertightness under longitudinal expansion and contraction movements.

CASTING YARD

The 500 by 2,600-foot level area used for a casting yard had standard gauge tracks, connected at one end of the yard with the main-line tracks of the Canadian Pacific Railroad and at the other end with the standard gauge tracks of the Municipal Service Line paralleling the aqueduct, over which the finished pipe were delivered to required positions alongside the trench. On the longitudinal axis of the yard there was installed 1,100 feet of 8-foot gauge track connecting the mixing plants at both ends of the yard and serving for the operation of the two pipe casting travelers. About 150 feet each side of this track there was a parallel standard gauge track for loading and shipping the finished pipes.

Between the traveler track and each loading track there were located 144 heavy concrete bases on which the pipe forms were set and the pipe were cast.

At each end of the yard there was a low trestle over which cars of graded sand and gravel were delivered to storage bins of an aggregate capacity of 3,000 yards, which were provided with steam pipes to warm the aggregate in the winter, and from which there were supplied by gravity a battery of four Little Wonder concrete mixers, each of 10-foot capacity.

The contractor's offices and service buildings were located midway between the mixer plants, and reinforcement storage and assembling yards were located between the mixing plants and the ends of the casting yards, which were symmetrical about both longitudinal and transverse axis.

CASTING THE PIPES

For interior reinforcement, the woven mesh was formed on collapsible mandrels, the overlapping edges were wired together, the fabric was reinforced by rods wired on when necessary, and the cylinders were stored until required for use. The exterior reinforcement was made from straight rods bent at the yards over mandrels to form the spirals that were wired to longitudinal rods, making complete skeletons placed as units in the forms. Each form was assembled on a grooved cast-iron bottom piece on the concrete slab. The collapsible steel interior form was set on it and carefully centered. The concentric fabric reinforcement was placed around it and seated in the annular groove in the bottom casting, which was then filled with sand. The skeleton reinforcement was centered over the fabric reinforcement and the exterior steel form, consisting of two longitudinal halves connected by pivoted latches, was set in place.

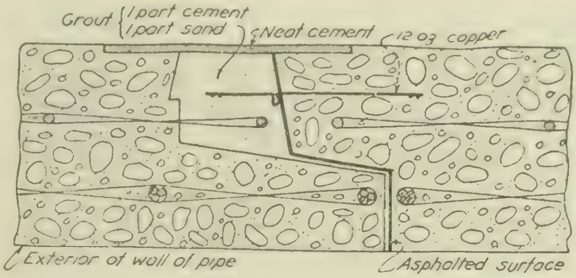
The top of the inner form was closed by the working platform set on it, and grout was poured into the bottom of the form, after which the form was filled with concrete to a point near the top, when mortar was added and a steel spider centered with the form to support the joint mould and the copper sleeve.

Each battery of four mixers discharged into special 1½-yard conical steel buckets set in a pit and handled by tackles suspended by the overhead horizontal arms of the two steel travelers on the center track, along which it was traversed by its hoisting engine winding an anchored line. The concrete was deposited in the center of the working platforms and thence filled by hand into the forms and tamped. The discharge of the concrete from the buckets to the platforms was regulated by the ball valves at the bottoms of the buckets that were operated by exterior levers. Each traveler delivered concrete to two forms simultaneously and was operated by ten men, including engine man and concrete gangs, and cast pipes at the rate of 36 pieces, or 288 lineal feet, per day.

PLACING REINFORCEMENT IN FORMS

CURING AND HANDLING THE PIPES

As soon as the pipes had been cast, the forms were covered by canvas jackets laced up and down the vertical joint and secured to the concrete base. The canvas hood, supported by wooden arms attached to the spider so as not to displace the light copper sleeve, was placed on top of the cylinder and laced to it. Live steam was admitted to the interior of the pipe through one center jet and four equi-distant circumferential jets piercing vertically through the concrete base.



WATERTIGHT EXPANSION JOINT WITH EXTENSIBLE COPPER SLEEVE

When the pipes were twenty-four hours old the jackets were removed and the forms were stripped, cleaned, assembled, and used on another set of pipes. The jacket and hood were replaced and steam was again turned on for two or three days before the pipes were removed from the concrete bases and stored on the skids.

The pipes were lifted from their bases by a horizontal beam about 7 feet long attached to a hoisting tackle on the traveler suspended from one end of the traveler cap, and counterweighted by a balance box suspended from the opposite end of the cap.

DELIVERING CONCRETE TO WORKING PATFORMS ON FORMS.

LIFTING STRIPPED PIPE FROM CASTING SLAB

At each end of the hoisting beam there was attached one end of a chain that was wove around sheaves at opposite ends of a flexible semi-circular steel band placed horizontally on the outside of the pipe midway between the ends.

Putting the hoisting strain on the chain developed a tension that pulled this band tight and produced sufficient friction to enable it to lift the pipe section free of the base, after which it was easily revolved about the center of gravity in a line passing through the chain sheaves, and when in a horizontal position was lowered to rest on wooden skids transverse to the traveler track.

PIPES ENCLOSED IN CANVAS HOODS AND JACKETS TO RETAIN STEAM.

The pipes were first rolled to the outer ends of these skids and afterwards the space between them and the derrick track was filled with additional pipes stored until required in the trench, when they were removed from the outer ends of these skids by locomotive cranes that transferred them to cars on the service track. While the pipes were seasoning in the yard or on the skids, they were periodically sprayed with a water jet to prevent dehydration.

LOCOMOTIVE CRANE LOADING PIPE ON CARS

Charleston's Way of Getting an Incinerator

The city Department of Health and prominent citizens of Charleston, W. Va., have put it emphatically before the citizens that the situation as to garbage disposal in that community has reached the point where immediate action is imperative. At a special meeting of the Chamber of Commerce held a short time ago, a special committee on garbage disposal made its report and the Chamber of Commerce unanimously adopted resolutions urging the necessity of protecting the health of the people and guarding against difficulties with the Federal government by providing some sanitary method of garbage disposal. Dr. R. A. Ireland, chairman of the special committee, stated that 6,000 out of 10,000 families in that city were spending 25 cents a week for having their garbage removed, or a total of $78,000 a year. The Chamber of Commerce appointed a committee of ten to make arrangements for financing the project, and it was thought probable that the plan adopted would be that by which the city purchased its fire apparatus, when the citizens underwrote the amount necessary. It is believed there is enough popular opinion in favor of the project to make it perfectly possible to get the citizens to underwrite the amount necessary to erect a modern incinerating plant, furnishing the funds for construction, which will later be returned to them by the city.

Proposals For Portland's Garbage Disposal

Four proposals have been made to the city of Portland, Ore., to erect garbage-disposal plants and to operate them, or to allow the city to operate them upon completion. The Pacific Conservation Company of San Francisco and Los Angeles made two proposals. In the first bid the company offers to erect a reduction plant equipped with a Cobwell system and sell it to the city on a cost plus 1 per cent basis, with a guarantee that the plant would not cost to exceed $350,000.

In the second proposal made by the same company, which is but a tentative plan, an offer is made to erect and operate the plant and also take over the collection of garbage in Portland, providing the city will grant the company a franchise for the exclusive collection of garbage, and pass an ordinance requiring the segregation of garbage.

The company offers to make two collections of garbage weekly, with a monthly charge of $1, and will pay the city $20,000 a year for the privilege. This amount, together with a saving estimated by Commissioner Bigelow at not less than $20,000 now spent in the operation of the municipal incinerator, would net the city approximately $40,000 yearly on the proposition.

The Washington-Oregon Nu-Fuel Company offers to install plants for the disposal of all garbage and combustible material, paying the city 50 cents a ton for all such material delivered to the plant. This offer is made with the provision that the city establish a municipal garbage collection system.

Another offer was made by the Pacific Cremation Company, which included the erection of a new incinerator for the city at a cost of $62,000 for one 50-ton furnace, or $134,000 for four 50-ton furnaces.

The same company also offers to remodel the present plant, and install three furnaces for $60,000.

The bid for the sale of new furnaces, with the exception of the last named offer, includes the erection of new buildings in connection with the incineration plant.

Report on Philadelphia's Water Supply

The committee appointed by the mayor of Philadelphia to study the city's water supply, submitted its report the last week in September. The committee does not report very encouragingly concerning ground water supply, finding this to be small in quantity and highly impregnated with mineral water, making it unsuitable for domestic or industrial purposes; although final conclusions are deferred until certain test wells have been sunk, for which contracts are about to be let. They report, however, that during the next five or six years the supply must be extended, and recommend the construction of an impounding reservoir on Perkiomen creek at an estimated cost of $8,000,000; improvements in and extensions to the Delaware river supply works at a cost of $6,000,000 and to the Schuylkill river supply works at a cost of $4,000,000. They also recommend the expenditure of $8,000,000 for the extension of the distributing mains and construction of a distributing reservoir for the northeastern part of the city, $5,000,000 for extensions and betterments to existing distribution reservoirs and main pipe lines, and $4,000,000 for general improvements essential for the safe maintenance of the plant. These should be completed during the next five or six years, but during the next fifty years other extensions should be made at an estimated cost of $134,900,000 (these costs being based on present costs of material and labor). These future expenditures consist of $56,073,000 for reservoirs and headworks, $50,819,000 for aqueducts to bring the water to the city, and $28,000,000 for changes in filtration plant and the distribution system. These recommendations for the half-century period are based on an estimated population fifty years hence of 3,250,000.

The ground water supply had been reported upon at the express request of the mayor, but other citizens have for some time been urging bringing a supply from distant mountain regions. Concerning this, the commission remarked that the general public were accustomed to think of a mountain supply as the clear, cool water which they find in mountain springs. But before mountain water can be accumulated in sufficient quantity to furnish any material proportion of the quantity needed by a large city, it has passed through regions or conditions which cast doubt upon its safety, has received the wash-off of the soil so that its clarity has been damaged, and when impounded in reservoirs its coolness quickly disappears. The water of the Lehigh and Delaware rivers above the Water Gap is at times turbid, has a high color or vegetable stain, and would be subject to dangerous pollution; and to be satisfactory for a public supply it would need to be treated to remove these objectionable qualities. The cost of bringing the water would be enormous, and the quality would probably be no better than could be obtained much nearer at hand at a very much lower cost.

Water Bonds in San Francisco

An amendment to the charter of the city of San Francisco is to be voted upon in that city which would provide for withdrawing water bonds from the 15 per cent legal limit of bonded indebtedness, which appears to be necessary if the city is to complete any of the water projects under discussion or even already started, as the city has already gone within about $32,000,000 of its legal limit of indebtedness. The vote on the amendment does not include any authorization for issuing bonds but merely makes it possible for the citizens to vote the necessary bonds for water projects by casting a two-thirds electoral vote in their favor.

Testing Water Meters in Series

In a paper before the New England Water Works Association, J. E. Garratt, office engineer of the Board of Water Commissioners of Hartford, Conn., discussed the question whether water meters would show the same percentage of registration whether tested singly or in series of two, three, ten or any number.

He first called attention to the fact that, when the discharge is indicated as the flow through a ⅛-inch, 1-16-inch or other size orifice, the matter of pressure is overlooked. If the pressure in a given laboratory is always the same and the meters are tested singly, no error may be involved in this. There is, however, a certain loss of head in passing through a meter, and four times as much loss in passing through four meters. Consequently, where a number of meters are tested in series, the head on the testing orifice is less than where only one meter is tested and consequently the volume of flow is less. He therefore emphasizes the fact that in all meter testing the flow should be designated as so many gallons or cubic feet or pounds of water per minute and not as the flow through an orifice of stated size.

Given this method of indicating results, and the percentage of registration is entirely independent of whether meters are tested singly or in series. Where the testing is made at very low rates the loss of head is insignificant and the effact of multiple testing on orifice flow is insignificant, but as the head increases beyond 1-40 of a cubic foot per minute for a ⅝-inch meter, the difference becomes more apparent.

Water Works Extension to Cost $5,750.00

The Swan Lake system of extensions of the water supply of Seattle will cost approximately $5,750,000. This was the estimate submitted to the council utilities committee by City Engineer Dimock. The total amount expended to date is $400,533.

When completed the Swan Lake project will furnish a water supply sufficient to meet the needs of the city for 25 years, it is estimated. The project includes the construction of a dam at the lower end of Swan Lake, which will create a reservoir into which water from Cedar river will be diverted, a pipeline leading from the reservoir to another reservoir in the city, and the construction of a storage reservoir within the city limits.

Bethlehem Buys Water Works

The city of Bethlehem, Pa., on September 28, became the owner by purchase of the plant and property of the Bethlehem City Water Company. The city paid $1,700,000 for the property, which sum had been obtained by the sale of 4½ per cent water works bonds, from the sale of which it received par value and accrued interest.

The Fourth International Road Congress

By Arthur H. Blanchard *

The author, who has played a prominent part in the first three International Road Congresses, describes the purposes and accomplishments of these Congresses and presents a plea that highway engineers urge Congress to enter the United States as a member of the Permanent International Association of Road Congresses.

The First International Road Congress was held in Paris in 1908. At this Congress, the Permanent International Association of Road Congresses was formed with headquarters in Paris. The Second Congress was held in Brussels in 1910.

The Third International Road Congress was held in London in 1913, at which time there were 3,793 members of the association. The business sessions of the Congress occupied about one week and were devoted to a thorough discussion of the subject matter of 123 reports pertaining to the 19 topics on the program of the Congress. During the final business session, progressive conclusions relative to each topic were adopted by the Congress. The Government of the United States was the only world-power which was not a member of the association when the Third Congress was held. The records of the Third Congress indicate that the following important countries were members of the association: Austria, Belgium, France, Germany, Great Britain, Italy, Japan, Norway, Portugal, Russia, Spain, Sweden and Switzerland. Of the smaller countries, it is interesting to note that our neighbors, Cuba and Mexico, sent Government delegates to the London Congress and are Government Members of the association.

The International Commission of the Permanent International Association of Road Congresses, at its meeting held in Paris on June 21, 1920, unanimously voted to accept an invitation in the United States in 1922 provided an invitation from the United States Government is received by the Executive Committee of the association before January 1, 1921. If an invitation is not received from the United States on or before December 31, 1920, the invitation from the Italian Government will be accepted. As a regulation of the association stipulates that an International Congress cannot be held in a country whose Government is not a Permanent Member of the association, it will be necessary for the United States Congress, during November or December, 1920, to pass an appropriation which will provide for the annual subsidy of the United States as a Government Member of the association and which will enable the Secretary of State to extend an official invitation to the association to hold the Fourth International Road Congress in the United States in 1922.

The object of the association is to promote progress in the improvement of highways and the efficiency of highway transport throughout the world. The work of the association consists in organizing International Road Congresses, publishing reports, papers, proceedings and other documents and collecting information relative to highway improvement and highway transportation.

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*Professor of Highway Engineering and Highway Transport, University of Michigan, Ann Arbor, Mich.

The membership of the association consists of representatives of Governments, delegates for corporations and individual or private members. The business affairs of the association are managed by the Permanent International Commission, which is composed of members representing the various Governments having membership in the association. Each Government has the right to one representative for each 1,000 francs of its total annual subsidy, provided, however, that the number of representatives from any one Government does not exceed fifteen.

Individual or private members pay annual dues of 10 francs, or compound for a life subscription by the payment of one sum of 125 francs. Due to the current rate of foreign exchange, it is practicable for Americans to become Life Members by the payment of the subscription of 125 francs through the medium of a bank draft, which will cost, at the present time, between $9.50 and $10. Life membership dues should not be sent by an International Postal Money Order, as an order for 125 francs will cost approximately $25. Bank drafts should be made payable to the Permanent International Association of Road Congresses and be sent to Professor Paul LeGavrian, General Secretary, Permanent International Association of Road Congresses, 1 Avenue d'Iena, Paris, France.

Individual members receive, free of charge, all of the publications of the association, including papers, reports and proceedings of Congresses, which, in times of peace, are held triennially. The reports and proceedings of the Third International Road Congress measure, when stacked, about 6½ inches by 9½ inches by 8 inches in height. The reports contain reliable information pertaining to the progress in highway development and highway transportation in all important countries and hence serve as an encyclopedia of foreign practice. Members also receive the Bulletin of the association, each issue consisting of forty to fifty pages devoted to official notices, minutes of meetings of the International Commission and the Executive Committee, and reviews relative to highway improvement and highway transport in different countries. All the literature, sent to American members, is printed in English.

The International Association should be supported by Americans who wish to see the science and art of highway improvement and highway transport rapidly develop throughout the world, who believe in an international medium for the exchange of opinions and conclusions, and who wish to be well informed relative to progress in highway engineering and transportation in foreign countries. Americans should not be satisfied with joining the association as individual members. Although every courtesy was extended to the United States members of the association at Paris, Brussels and London, nevertheless every American who has attended an International Road Congress has wished to apologize because his Government was not a Permanent Member of the association. Considering the phenomenal development of highway improvement and highway transport in the United States and the active part which the United States Government is taking in highway construction through the medium of the Federal Aid Act, it requires no elaborate arguments to demonstrate the advisability of the United States Government becoming a permanent member of the association. The status of the United States as a leading world-power demands that its annual subsidy should be the maximum allowed by the constitution of the association, that is, 15,000 francs, which will provide for fifteen representatives of the United States on the Permanent International Commission. It is the duty of every American who wishes to support the work of the International Association and to have an International Road Congress held in the United States in 1922 to write to his representatives in Congress urging them to vote favorably on an appropriation to provide for the annual subsidy of the United States as a Government Member of the Permanent International Association of Road Congresses.

Road Experiments of the Bureau of Public Roads

The Bureau of Public Roads of the United States Department of Agriculture is conducting a series of experiments which promises to be of great value to highway engineers. These experiments will continue for several months or years, but already sufficient has been learned to give an indication of the results. For instance, they indicate that increased speed of a vehicle equipped with hard rubber tires tremendously increases the impact which its wheels make on the roadway if there is any unevenness of the surface; and on the other hand, with pneumatic tires increased speed adds little to the impact. Trucks varying from 1 ton to 7½ tons have been used in the tests. A special device recorded the impact of each wheel as it made a 2-inch drop from a ledge built in the road surface.

Recent tests were made with a 3-ton truck carrying a 4½-ton load so placed that the total weight on each rear wheel was 7,000 pounds, of which 1,700 pounds was not supported by the springs while 5,300 pounds was so supported. This truck was equipped first with an old solid tire that had worn down to a thickness of 1 inch; then with a new solid tire 2½ inches thick; and finally with pneumatic tires 42 x 9 inches and inflated to a pressure of 142 pounds per square inch. The other conditions were the same in all the tests. The blows delivered when the speed approximated 5.7 miles per hour were measured as 11,600 pounds with the old tire, 9,400 pounds with the new solid tire and 7,100 pounds with the pneumatic tire. When the speed increased to 10.2 miles per hour the impacts were increased to 18,500 pounds, 14,100 pounds and 7,800 pounds, respectively, while when the speed reached 14.6 miles the impacts increased to 26,500 pounds, 18,700 pounds, and 8,300 pounds. This shows that, with an increase in speed from 5.7 to 14.6 miles, impact from the old solid tire was increased about two and one-half times, that from the new tire about twice, and that from the pneumatic tire only about 17 per cent.

Another series of tests was made on slabs of pavement by means of a machine designed to give impacts equivalent to those described above, the unsprung weight being 1,500 pounds and the sprung weight 6,000 pounds. The tests were made by dropping the entire weight ⅛ inch 500 times, ½ inch 500 times, ⅜ inch 500 times and so on until the slab failed. The slabs were tested lying on a rather wet sub-grade. A surprising difference has been found in the strength of the different types of pavements tested. The total number of blows required to cause failure have varied from 67 to almost 2,000.

Another series of tests is being made to determine the relative wear of different kinds of pavements. The relative wearing qualities of hard and soft brick and of various kinds of stone blocks are brought out, comparisons made between grout and asphalt fillers for both brick and stone blocks, and the relative wearing qualities of concrete when mixed with various kinds of coarse aggregate.

Road Construction in North Carolina

The North Carolina Highway Commission now has under construction 57 projects of which the estimated cost is slightly over $7,000,000. These projects include 21 hard-surface roads totaling 114 miles, 35 gravel and sand-clay roads totaling 339 miles and a concrete bridge. Sixteen miles of hard-surface roads in six projects have been completed at a cost of $507,380, and 5 7miles of gravel and sand-clay roads at a cost of $202,693.

The work being done is spread quite generally over the state, more than half the counties having taken advantage of the Federal Aid offer. The largest amount of work being done in any one county is that in Buncombe county, where more than one-half million dollars' worth of construction is under way.

The Lee Highway

Virginia has the reputation of being one of the most backward states in the eastern section of the country so far as improved highways is concerned, but it is hoped by many of the citizens that conditions will be greatly improved within the next year or two. Last spring there was organized the Lee Highway Association to promote a transcontinental highway through the south, and permanent officers of the association were elected in September and Roanoke chosen as headquarters.

The highway is intended both as a memorial to Gen. Robert E. Lee and to serve the utilitarian purpose of connecting the north with the south by a single stretch of improved roadbed. Dr. S. N. Johnson, the general director, states his belief that the construction of this highway through the Valley of Virginia will result in the construction of many lateral roads and greatly increase the shipping of goods by truck throughout the state. The highway will naturally pass through Lexington, which is the burial place of both Gen. Lee and Stonewall Jackson. Because of the historic interest, scenic beauty and for practical purposes, the route has been fixed from New York, through Philadelphia, Baltimore and Washington to Alexandria and Winchester, and thence by the Valley of Virginia and East Tennessee to New Orleans. It is the intention, when this section has been completed, to extend the road to San Francisco by way of El Paso, San Diego and Los Angeles, making it the southern counterpart of the Lincoln Highway in the north.

Repairing Elizabeth's Bridge Piers

An examination of several bridge piers at Elizabeth, N. J., on the Elizabeth and Rahway rivers, made some months ago, showed that the concrete in them had disintegrated to a dangerous degree, the corrosion in some places extending to a depth of 6 inches from the face. The matter was referred to a committee who obtained the opinion of consulting engineers and chemists as to the cause of the damage and best remedy therefor. The zone of disintegration appears to be limited to the area between high and low water marks, and consequently repairs made in the ordinary way would require the building of a coffer dam around each pier or some other method of excluding the water until the concrete or other masonry used for repairs had set. This would be an expensive procedure.

Professor E. L. Conwell, a consulting chemist of Philadelphia, reported that analyses of the river water showed soluble salts of hydrochloric and sulphuric acids in considerable quantities. Also Elizabeth river water was found to contain from 20 to 200 times as much salt as was found in other streams of the state not exposed to industrial pollution.

One of those consulted was Ralph L. Shainwald, Jr., vice-president of the Standard Paint Company. He said that he found that crystals of salt formed in holes and crevices of the concrete, and in the considerable expansion accompanying crystallization, forced off flakes and particles of the concrete. He recommended chipping away all of the damaged surface and applying a coat of cement mixed with a compound which is both waterproof and acid-proof. This material can be applied by heating the surface of the piers to a high temperature with a blow-torch and applying the plaster, which will set rapidly and permit the repair to be made during the twenty minutes or so of extreme low tide when all of the damaged surface is exposed. He estimates that repairs made in this way will cost approximately $3,000, whereas the construction of coffer dams to permit concreting in the usual way would cost about $10,000. The County Board of Freeholders is reported to have decided to use acid-resisting and waterproof material for the concrete abutments to be used in connection with a proposed new street bridge on South Front street.

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Gravel Roads

As compared with concrete, bituminous concrete and other more durable roads, comparatively little has been written or reported concerning gravel roads, and yet the mileage of such roads constructed with Federal Aid in the United States during 1919, and also that during the three years, 1917, 1918 and 1919, exceeded by far the mileage of any other type of road other than plain earth roads and almost equaled the total of all other kinds, and the mileage of earth roads only slightly exceeded that for gravel. Owing to restrictions placed upon roads which receive Federal aid, it is probable that, could figures for all roads in the country be obtained, the showing made by gravel roads would be even better. In some states more than three-quarters of all the roads in the state are built of gravel.

Even taking the costs of the roads, we find that, although gravel is a very cheap road to construct as compared with the more durable ones, the total cost of Federal aid gravel roads during the three years, 1917, 1918 and 1919, was two-thirds as great as that of all the other roads combined, omitting concrete. To give the exact figures, there was spent on Federal aid gravel roads $10,238,678; on concrete roads, $18,172,084; on earth roads, $6,645,245, and on all others combined (these including sand-clay, macadam, macadam with mat top, bituminous macadam, bituminous concrete, brick, and miscellaneous), $14,720,460.

With such a large proportion of the country depending upon gravel roads and with such large sums spent in their construction, it would seem desirable that more attention be given to this class of road by engineers and other road experts. Probably ten times as much has been done in the way of experimenting and has been written by engineers concerning bituminous concrete roads as concerning gravel, and yet nearly four times as much money was spent during the three years named on gravel as on bituminous concrete.

We expect to publish next week some ideas of specialists on gravel roads and hope that the present indications that a more serious interest in gravel roads is being taken by highway engineers will be borne out by later development.

Refuse Utilization Difficulties

Within a very few weeks reports have come of two companies holding contracts for the disposal of municipal refuse having abandoned these contracts because of the inability, or at least the failure, of the municipal authorities to secure a satisfactory separation of the refuse, especially of solid rubbish from the garbage. Each of these companies has stated that the presence in the garbage of bottles and pieces of metal, stones and other hard objects has resulted in a breaking of the machinery through which the garbage is passed and that unless the city authorities can induce the citizens to keep the garbage free from such objects it will be impracticable for these companies to carry out their processes.

It does not appear whether the citizens of Boston and of Atlantic City are more difficult to control in this matter of garbage separation than those of other cities or whether the utilization processes and machinery used is different from that used by the several cities which have for years been disposing of garbage by utilization processes of one kind or another. These two instances, however, would seem to point to one of the difficulties in the utilization of municipal refuse, this being the necessity of securing a more or less complete separation of the refuse into at least two, and even three or four, different classes.

In the case of incineration this necessity of separation would not appear to be so great, although even for that method of disposal it is generally desirable to separate out from the combustible matter that which is incombustible and only clogs or smothers the fire, such as fine ashes and dirt, watermelon rinds, corn cobs and certain other materials. As long as there are careless and thoughtless people there will be difficulty in securing this separation, even after the citizens generally have been convinced of its desirability. And yet certain cities have been fortunate enough to obtain officials who have appeared to be quite successful in this respect. For instance, Minneapolis and Trenton taught their citizens to drain their garbage and wrap it in paper before depositing it in the pails, and we believe that in a comparatively short time the citizens observed this regulation quite generally.

This is one of the many problems arising to complicate the question of what method of disposal of refuse will be best for any given city. This question of refuse disposal is by no means an easy one to settle, and, in fact, there appear to be few cities where it has been settled satisfactorily to all concerned, if we include among these the residents in the vicinity of the place of disposal, whether this be a dump, a utilization plant or an incinerator; including also the taxpayers who have to pay the construction and operating expenses and the householders who have to purchase and keep on hand one, two or three receptacles required and perform the necessary separation of the refuse deposited in them.

Poor Back Filling Costs $7,500

In Waltham, Mass., there was constructed in 1881 a storm sewer 36 inches in diameter, constructed of a single course of brick laid in natural cement, which lies at one point 18 feet below the surface of the roadway. About eleven years later a trunk sewer was laid in the same street 20 feet below the surface and 5 or 6 feet away from the storm sewer. In spite of the danger which this threatened to the storm sewer, especially in view of its light construction, it would appear that the back-filling around the trunk sewer was not made as thoroughly and compactly as it should have been, for the back filling continued to settle slightly year by year, permitting the ground between it and the storm sewer to fall away from the latter, which finally cracked on the underside toward the trunk sewer and finally, in 1919, settled and collapsed for a distance of over 100 feet and was badly cracked for another 100 feet. About 1906 an 8-inch water main had been laid in the same street about 5 feet deep and crossing diagonally over the storm sewer for a distance of about 140 feet. When the storm sewer collapsed the earth between it and the water main above settled, the water main broke in two and the rush of water from it added considerably to the damage done by the break in the sewer.

The work of repairing the storm sewer and water main required two months of time and an expenditure of $7,490, and seriously interfered with carrying out the city's program for general repair work on the streets, since a large part of the labor used would otherwise have been employed on street work. The excavation was handled with a Carson trench machine, as the limited number of men available, the unusual depth of the trench and the loose gravel soil made hand-digging impracticable. Of the total cost, $4,519 was for labor, $2,311 was for material, and most of the remainder was for teams and trucks and machine hire, the last being $336.

Construction Costs in the Philippines

In a letter dated Manila, P. I., August 26, A. G. Hillberg, civil and hydraulic engineer, formerly of New York City, writes:

"You mention about the bad conditions in the United States and the difficulty of making both ends meet on the salaried positions. The same conditions exist out here because labor and materials ran up tremendously during the past two or three years. It does not look as if the cost of materials would be any lower for the coming four or five years, but labor may come down somewhat.

"However, the costs of construction labor in the Philippines is not excessive as compared with labor in America. The Filipino laborer is not as efficient as the laborer we employ in the States, but he is only paid from 75 cents to $1, gold, a day, consequently even if he is 40 or 50 per cent efficient as compared with labor in America, the labor costs are still less than half of what they are in the States.

"Costs of materials, however, are almost double of what they are in the States and this brings about the curious conditions that in construction work materials cost about 75 per cent and labor 25 per cent. In the States it is almost the reverse, viz.: materials 25 per cent and labor 75 per cent."

Highway Detours

In a discussion at a meeting of the executive committee of the League of Improvement Societies at Providence, R. I., on September 22, the practices followed in respect to detours around sections of highway under construction were condemned. Among other things, it was the general opinion that before any section of road was torn up by contractors for making repairs or reconstructing, the detours necessary should be placed in a passable condition. Many accidents and much expense from breakage of automobiles had resulted from the poor condition of detours during the past summer. The committee also expressed the opinion that contracts for repairing state highways should contain provisions that shorter stretches of road be torn up during repairs, the present practice of tearing up the whole road resulting in unnecessary inconvenience to motorists and traffic generally.

The National Construction Situation

Data furnished by Associated General Contractors in all parts of the country covering fundamental causes of present conditions, and recommendations for Government Action

The Associated General Contractors have recently made to the Honorable William A. Calder, chairman of the Senate Committee on Reconstruction and Production, a statement regarding the present situation of engineering construction and housing in the United States, accompanied by recommendations for action that, in their opinion, will most quickly and efficiently relieve the present serious conditions.

By a questionnaire directed to its members and others, the association has received widespread and competent information regarding the existence and amount of abnormal construction conditions, the efforts that have been made to remedy them and suggestions for future action.

From a summary of these it is concluded that there exists a housing shortage of about $1,500,000,000; that the Federal highway program for 1920 amounting to $633,000,000 and a very large amount of other highway work has completely fallen through, and that railroad work, water-power developments, vast reclamation projects, harbor and river improvements and other public works are at a standstill.

FUNDAMENTAL CAUSES

Cessation of normal construction during the war is assumed to be the principal cause of the present shortage of construction facilities. The immediate problem faced, however, is the inability of construction industry to function efficiently at the present time. This is due to inadequate transportation facilities, restricted finance, high cost of materials, labor and strikes.

Transportation priorities granted to fuel caused a complete suspension of work on most projects requiring a large amount of bulky materials, especially east of the Mississippi river, which was aggravated by lack of cars and lack of ability to move them. If construction were to begin again with all its facilities, the same difficulties that existed early in the summer would at once reappear in large measure.

RECOMMENDATIONS

It is therefore recommended to the Interstate Commerce Commission that priority of transportation next to food and fuel should be given to materials for essential construction. Government aid should be extended to the effort of the Association of Railway Executives to reduce the standing time of freight cars. Reciprocal demurrage, based on a money consideration should be established. For individual loans to railroads there should be substituted the establishment of a National Trust, guaranteed by the Government, to purchase cars for the relief of all railroads and allot them to various lines to be paid for in ten years or less.

It was recommended that the Federal Reserve Board adopt a more liberal policy towards construction loans. This can be done by:

1. The rediscounting by Federal Reserve Banks of the notes of building and loan associations at lower rates.
2. The extension of more liberal credits to essential industrial extension projects.
3. The encouragement of the production of essential commodities and necessities through preferential discount rates.
4. A modification of income and excess profit taxes and the adoption of a direct commodity tax, especially on luxuries. Other features apply especially to the housing problem.

Prices of material are believed to be higher than are warranted, and the expectation of future increase restrains the investment of capital. It is, therefore, recommended that:

1. Retail prices, production, distribution cost and selling prices and manufacturers' prices and their relations should be investigated and fully published.
2. The Federal government should provide regular dissemination of information regarding current production and market prices of construction material.

LABOR

The high cost of labor is attributable to inefficiency and shortage. In some cities efficiency has been increased by curtailment of work and open-shop policy. The labor supply has been inadequate for several years and can only be increased by immigration. There is a great scarcity of skilled mechanics and efficient trained workmen. Shortage is aggravated by idleness due to strikes, lockouts and lack of co-operation between employers and employees. The provision of judicial tribunals for industrial disputes, with authority to enforce their decisions is incumbent on the government.

The remedies suggested include:

1. The immediate encouragement of immigration and its supervision.
2. Extensive government aid to trade schools, to train apprentices in a range of related subjects wide enough to enable them to adapt themselves to changes of industrial conditions and reasonable demands.
3. A system of government courts to handle industrial disputes with power to enforce their awards.
4. Government encouragement to a national conference of construction employers, employees and other related interests.

Southern Pine Production

The Monthly Trade Barometer for August of the Southern Pine Association, representing 204 subscribers in the states of Louisiana, Alabama, Oklahoma, Texas, Arkansas, Mississippi, Florida and George, shows that the combined cut for August was 383,539,945 feet while the stocks on hand August 31 were 1,355,979,024 feet. The August shipments were 88.04 per cent and the demand 84.95 per cent of production, the stocks on hand being increased 45,862,846 feet or 3.5 per cent. The production for the month was 75.87 per cent and the orders were 64.45 per cent of normal. On August 31 the stocks on hand were 509,665,407 feet or 62.28 per cent more than August 31, 1919. The total exports during August through southern ports were 57,822,876 feet.

Seattle's Municipal Street Railway Loses Money

That Seattle's municipal street railway system is being operated at an average daily loss of $3,213.76 despite the increase in rate of fare recently put into effect became known in connection with a report by C. L. Hammons, statistician of the street railway department.

During the period from July 24 to August 23, inclusive, the first month of the 6¼-cent fare, the actual fare receipts were $496,034.35, according to this report. This gives an average daily revenue from fares of $16,001.10, which is increased to $16,447.94 by the addition of daily average receipts from miscellaneous sources of $447.94.

Daily operating costs, based on the July report, Mr. Hammons states, were $13,100.50; daily interest charge $2,404.60; daily depreciation charge $1,880.52; making the total daily cost of the railway $17,385.62. Subtracting from this amount the average daily revenue of $16,449.04, Mr. Hammons finds the daily deficit to be $936.58, to which he adds $2,282.18 as the daily average amount to be set aside for the redemption of outstanding bonds, which brings the total daily deficit under present operating conditions to $3,218.76.

Mr. Hammons includes in his report a comparison showing $496,034.35 as the actual revenue for fare receipts during the month from July 24 to August 23 and $388,972.63 as the amount that would have been received had the same number of passengers been carried on the old rate of fare, 5 cents. From this he claims a revenue increase of $107,061.72 for the month. City officials declare this increase is only apparent in part, as Mr. Hammon's own figures on the number of passengers carried show that the total for the month of August, with the 6¼-cent fare in effect, was 6 per cent less than that of the previous month when the 5-cent fare prevailed.

Electric Light and Power Stations

Figures just published by the United States Census Bureau for the year 1917 show that there were nearly twice as many commercial stations as municipal, with 23 times as much value of plant, 24 times as much output of current, 12 times as much income. Data by geographical sections are given in the summary

The Bureau of the Census has just published a report on central electric light and power stations, the figures and other data being for the year of 1917. Although these figures are now nearly three years old, the condition of the country has been such during those three years that they are probably more nearly applicable to present conditions than a three-year-old report would have been at any other time during the past twenty-five years. The tables give figures separately for commercial and municipal central electric stations, each arranged by geographical divisions.

The value of plant and equipment of the commercial stations was $2,933,016,941, while that of municipal stations was $127,375,200, or less than one-twentieth as great. Comparing the total assets, the difference is even greater, these being $3,631,973,213 and $148,345,165, respectively. There were 4,224 commercial stations and 2,318 municipal stations, showing that the average commercial station was about ten times the size of the average municipal.

Comparing the incomes, we find the total income by the commercial stations was $486,634,021, and that of the municipal stations was $40,260,219. The general ratio between total incomes is approximately the same as that between returns from sale of light and heat, power, and municipal street lighting, respectively, but the municipal stations sold electric energy to other public service corporations to the amount of $317,326, while this item for the commercial stations was $57,207,466. On the other hand, the commercial stations furnished free service estimated at $524,820, while the municipal stations furnished free service estimated at $5,095,843.

In matter of equipment, the commercial stations operated 10,387 units with a total horsepower of 12,077,657, while municipal stations operated 3,408 units with a total horsepower of 859,098. Of the total units in the commercial plants, about 51 per cent were steam, while in the municipal plants 65 per cent were steam. In the commercial plants 30 per cent were water-wheels and turbines and in the municipal plants about 7 per cent, while about 19 per cent of the commercial units were internal combustion engines and 28 per cent of the municipal units.

During the year the commercial stations had an output of 24,398,983,183 kw. h., while the municipal stations had an output of 1,039,320,089 kw. h.

Comparing the number of street lamps to which current was furnished, the commercial stations operated 206,957 arcs and the municipal stations 49,993. Of incandescents, the commercial stations operated 962,908 and the municipal 120,311. The commercial stations served 6,202,189 customers and the municipal stations 976,514 customers.

NUMBERS AND CAPACITIES BY SECTIONS

The number of commercial stations was 4.3 times as many as the municipal in New England, 4.5 times as many in the Middle Atlantic states, 1.4 in the East North Central, 1.3 in the West North Central, 1.2 in the South Atlantic, 1.7 in the East South Central, 2.3 in the West South Central, 3.6 in the Mountains and 4.3 in the Pacific states. In a few states the number of municipal stations exceeded the commercial, Minnesota having 133 municipal and 122 commercial, Nebraska 149 municipal and 140 commercial, Kansas 186 municipal and 116 commercial, North Carolina 80 municipal and 79 commercial, Georgia 128 municipal and 48 commercial, Oklahoma 106 municipal and 95 commercial. When it comes to a comparison of the capacity of the stations, however, the figures are very much more favorable to the commercial plants. The 133 stations in Minnesota, for instance, have only 31,655 horsepower in their primary power plants as against 196,584 horsepower in the 12 commercial plants. In output of stations there is nothing like approximate equality between commercial and municipal stations in any state except those of Florida and Washington, the municipal output in the former having been 23,119,667 kw. h. as against 27,768,325 for the commercial stations, while in the state of Washington the output of the fourteen municipal stations was 123,487,135 kw. h. and that of the seventy-four commercial stations was 118,883,821. In the latter state the commercial stations used steam for their primary power to a total of 21,770 h. p., while the municipal plants generate only 14,500 h. p. by steam, this being developed by two steam turbines. In the municipal plants, waterpower is used for the remaining 57,340 h. p., while in the commercial stations water-power is used for 56,828 h. p., and internal combustion engines for 600 h. p.

In the ten years, between 1907 and 1917, the commercial stations increased 22 per cent in number and 201.1 per cent in gross income, while the municipal plants increased 85.1 per cent in number and 187.3 per cent in gross income. In other words, the rate of increase in the revenues of commercial plants has been more than nine times as rapid as the growth in the number of stations, while for municipal plants it has been little more than twice as rapid. The gross incomes in 1917 totaled $40,260,219 for the municipal plants and $486,634,021 for the commercial.

Comparing the rates charged, the averages for the entire United States for lighting were 5.6 cents per kw. h. by commercial and 4.9 cents by municipal, while for power the rates were 1.2 by commercial plants and 1.8 by municipal. The relation between rates was by no means uniform in the different sections of the country, the commercial rates for lighting being higher in some sections and lower in the others. For instance, the lighting rates by commercial plants averaged higher in New England, the East North Central, Mountain and Pacific States, but averaged lower in the other sections of the country. For power, however, the rates charged by commercial plants were lower in every one of the geographical divisions, although being higher in some of the individual states, as in Vermont, Illinois and Kentucky. The lowest state average rate for power was in Montana, 0.6 cent, while the highest average rates were 30.9 cents (municipal) in Wyoming and 6.5 cents (municipal) in New Hampshire. The highest lighting rates were found in Rhode Island, 13.1 cents (municipal), South Dakota, 12.0 (municipal), New Mexico, 11.7 cents (municipal); the highest commercial state rate being 10.7 in New Mexico. The lowest lighting rates were reported by California, 1.9 (municipal), Illinois, 2.4 cents (municipal), and West Virginia, 3 cents (commercial). In individual instances much higher rates are found than these averages, some small plants charging as high at 25 cents.

Traffic Tower for San Francisco

The tower shown in the accompanying photograph was recently completed at the corner of Market and Spear streets, San Francisco. It was designed to control an electrically operated switch for diverting certain cars of the United Railroads from the inner track to the Municipal or outer track. The switch is located at the lower left-hand corner of the illustration.

STREET TRAFFIC TOWER IN SAN FRANCISCO

Overloading Motor Trucks

Before a conference of county commissioners not long ago, Louis S. Sadler, state highway commissioner of Pennsylvania, stated that the highways of that state were being ruined by a clique of greedy men who were overloading their motor trucks, and that such overloading must stop. Said he: "Under existing laws, all we can do to a man who overloads a truck is to have him fined $100. Such men should be sent to jail, and unless some drastic action is taken by the next legislature, the entire road system of Pennsylvania, or at least those portions of it near the larger cities, will be in utter ruin."

Engineering College of University of Maryland

A. N. Johnson has been appointed Dean of the Engineering College of the University of Maryland as a first step in the reorganization of this college. An arrangement has been made with the State Roads Commission and the Bureau of Public Roads whereby an engineering experiment station will be established at and run in connection with the engineering college.

Mr. Johnson assumed his duties on October 1. On graduating from Harvard, he spent four years as a member of its faculty. In 1897 he became member of the National Highway Commission. From 1988 to 1904 he was State Highway Engineer of the U. S. Office of Public Roads; 1906 to 1914 State Highway Engineer of Illinois; in 1915 highway engineer of the Bureau of Municipal Research, New York; and since 1916 has been consulting highway engineer of the Portland Cement Association.

Mr. Johnson will be given a free hand in the development of engineering at the University of Maryland. Special emphasis will be placed on general civil engineering and highway engineering, while broad development of electrical engineering work along lines of electrical communication is intended. Mr. Johnson's title will be Dean of the College of Engineering and Director of the Engineering Experiment Station.

Dr. Samuel Sheldon

Dr. Samuel Sheldon, past-president of the American Institute of Electrical Engineers and professor of physics at the Polytechnic Institute of Brooklyn, died September 4, at Middlebury, Vt. After graduation from Middlebury College, Dr. Sheldon studied two years in Germany, receiving there the degree of Doctor of Philosophy and later from the University of Pennsylvania the honorary degree of Doctor of Science. During his connection of thirty-one years with the Polytechnic Institute of Brooklyn, Dr. Sheldon instructed over a thousand graduates, some of them having become famous in electrical engineering.

Dr. Sheldon was the author of several college text books, monograms and papers on special topics and for thirty years was a member of the American Institute of Electrical Engineers, serving in various official capacities. He was also a member of the Interurban State Railway Association and of several technical societies.

Hard Surface Roads for North Carolina

The North Carolina Good Roads Association is apparently bringing about in that state a sentiment for the construction of hard-surface roads as soon and as rapidly as finances and circumstances will permit. It reports that the people in all sections of the state are opposed to further waste of money on make-shift types of roads, such as sand-clay or top soil. During the recent rainy season the entire western part of the state found its roads almost impassable.

The Old Niagara Railroad Suspension Bridge

Reminscences of its maintenance and successive reconstructions.

In the discussion which followed the recent presentation to the American Society of Civil Engineers of a paper by C. E. Fowler on the railroad steel arch bridge over the Niagara river at Suspension Bridge, New York, some interesting reminiscences were presented of the suspension bridge which was replaced by the steel arch.

This famous structure, built by John A. Roebling in 1895, had a single track railroad on the upper deck and a highway and sidewalk on the lower deck and was the first long-span railroad suspension bridge. It had a span of 800 feet, stone towers 80 feet high, straight iron wire main cables, stiffening trusses with wooden struts and vertical braces and wrought-iron diagonal rods. The beams and stringers and both floors were of wood.

About twenty years after the bridge was built, there was reason to suspect the integrity of the main cables at the anchorages; and the late L. L. Buck exposed the old anchorages, discovered the corrosion of the wires near where they engaged the anchor pins, and so clamped the main cables as to take the stress under traffic of the vehicles and trains then crossing the bridge, and spliced new wires in the anchorages, without any material interruption of the traffic.

A few years later, Mr. Buck, whose great abilities were thoroughly appreciated by the bridge owners, was retained regularly as consulting engineer and decided that the old stiffening trusses had become inadequate for the increasing traffic, under which they deflected two or three feet.

REMOVING SUSPENDED STRUCTURE UNDER TRAFFIC

Mr. Buck undertook the then unprecedented task of replacing the wooden trusses with steel under traffic without interrupting either railway or highway service on the upper and lower decks of the bridge. He designed Hay steel trusses of the same dimensions as the wooden trusses; this being one of the very first applications of steel to structural work.

It was before the days of steam power or special plant of any kind in bridge erection and the erection was done entirely by hand, and done well and cheaply, although without hoisting engines, pneumatic tools or electricity.

Wrought-iron highway bridges were only just coming into use; the engineer had an unknown problem, and nothing to work with, yet he solved it successfully. Every portion of the old trusses was removed; the suspender cables were adjusted; the stresses in them were measured; the new trusses were heavily cambered and put in service, all in one season, and without a serious accident of any description.

In the erection force of about 200 men, not one of them except the superintendent would pass for any kind of a bridge man today, or at any time within the last 20 years. There were only two of the men that came from the bridge shops that had any knowledge whatever of bridges; the other men were picked up on the spot.

It is an interesting fact that about 40 per cent of the men commenced work with a confidential request that they be allowed to work on the United States side of the bridge, because of little irregularities in their private lives that made it embarrassing for them to work on the Canada side; and another 40 per cent of the men made the same request, reversing the sides. They were a hard-bitted crew, but on account perhaps of their little eccentricities, they were very bright, and many of them became expert. They included all sorts of mechanics, especially a lot of very poor carpenters, who had to cut out the old wooden trusses as the new ones were put in, and they never did it right; the hundredth time they did it, it was not done right. They could not cut to a templet. The old chords were cut out a piece at a time, and clamped to the new steel chords.

The pieces were all small and all handled by hand. The rivets, among the first steel bridge rivets, were driven by hand and gave some trouble reheating and finishing. For replacing the highway floor, there was used a short, portable elevated bridge, on rollers, which carried the traffic to and from it by a ramp at each end, while the old floor underneath was cut out and the new I-beams, diagonal rods and deck were assembled in its place. The men had to crawl on the old floor beams, 240 feet above the rapids, and insert those lateral rods, and there were only two men who would do that work.

The stresses in the suspender ropes were measured with a dynamometer. Very little difficulty was encountered in getting the stresses perfectly uniform. After the operator had become skilled in the adjustments, by tapping the suspender ropes with a hammer, or even by grasping by the hand, he could tell within a few pounds whether the stresses were uniform or not.

Great numbers of tools were carelessly dropped from the bridge. The river channel under it is only about 400 feet wide. That left a strip of 200 feet of pretty rocky territory on each side of the river, where the men dropped hundreds of dollars worth of tools from the bridge. So many fell on the land that it was finally made a practice to shut off work for half an hour or an hour on Saturday on one end or other of the bridge, and send a man down with a bag to recover the tools. He would bring back a load of big monkey wrenches and all sorts of tools.

RECKLESS BRAVADO

There were some pretty reckless fellows on the bridge, and two or three developed a good deal of rivalry. One of them dropped a valuable tool that fell on the rocks; he did not want to be held accountable for the loss of that tool. He did not like to report it. He did not want to go off the bridge and have it noted at the office that he went. So what did the idiot do but select, about 300 feet from one end of the bridge, a guy rope that ran from the lower chord of the bridge, diagonally up stream and down to a point on the shore some 400 feet away and 240 feet below, near the water's edge.

He climbed out, hung from the guy rope, and started down hand over hand, to make that perilous trip to the water's edge. His dearest foe seeing him safely started, and not to be outdone, went to the very longest guy rope, next beyond, and started down in a race. The assistant engineer got to the scene of activities just too late. It was humanly impossible for them to get back again, and they were already beginning to lose their nerve. He had an inspiration, and treated those men to a blistering calling down that was a combination of drill practice, football coaching, Pittsburgh shop abuse, and personal scarification intended to divert their attention from their great peril. He threatened to fire and fine the loser of the race and cursed them so roundly that instinctively they paid more attention to him than they did to their own danger.

As they went down their strength flagged; one fellow succeeded in getting within 10 or 15 feet of the ground, let go and dropped, fortunately fell into the top of a tree and did not get much hurt. Both were discharged, and next week taken on again.

PATCHING MASONRY TOWERS

A number of years after the trusses were renewed, Mr. Buck observed that the tops of the old towers were in very bad condition. The saddles on which the old cables rested there had become rusted solidly in place, and the temperature expansion and contraction of the cables caused the tops of those rigid masonry towers 80 feet high to deflect several inches. So Mr. Buck removed the damaged stones from the faces of the towers, and inserted new stones from the Chaumont quarries. He did a beautiful job in a wonderful way that gave the towers another short lease of life.

Finally, however, the towers got too bad for further patching. Then Mr. Buck built steel towers and suspended the main cable saddles from them by lashings of high tension wires rove under or through their bases.

This released the old masonry and still maintained railway traffic while workmen cut off the tops of the old masonry towers, put in the girders in the permanent steel towers, and reseated the saddles with their cables on them, after which they removed the old masonry towers and completed the interior bracing of the steel towers.

The bridge then stood for a number of years until Mr. Buck had the opportunity and the glory of rebuilding it, which had long been his ambition. His first plan was to build a cantilever across the gorge, and he was probably disappointed when C. C. Schneider built the Niagara cantilever, although he could not but recognize that the cliff formation there was adapted to the arch type of construction which he eventually built.

CANTILEVER ERECTION OF ARCH SPAN

The method of construction of the arch in the field was very interesting. It was carried out by R. S. Buck, who was L. L. Buck's exceedingly capable associate on the work. The arch was erected on the cantilever principle, the two ends being constructed simultaneously, with the tops of the vertical end posts guyed back to the anchorages. The material was handled by light travellers that moved on the deck of the old structure and delivered the members to the trusses under erection.

The arch structure, although carrying the railroad and highway at the same alignment and elevation, was proportioned to clear and enclosed like a trough, during its erection, the suspension bridge, which continued in service during the entire operation of constructing the arch bridge, while both arms were being built out on each side of the river, until as curved cantilevers they joined in the middle, and were made complete and self-supporting, and the suspended span was removed.

One of the most interesting pictures in a very extensive collection of photographs covering most of the history of bridge erection, is an historic one showing the bridge just before completion of that arch, the Schneider cantilever in the background, the suspension bridge still intact, and the arch bridge nearly completed, and partly enclosing the suspension bridge. With the completion of that arch Mr. Buck finished an important chapter of the historic Niagara bridge, and achieved great credit for himself and the engineering profession.

Labor Notes

Director U. S. Employment Service says: "Coming winter will be one of the best in years as regards opportunities for employment, with the exception of the war years, when there was an absolute general shortage of labor."

About 1,200 Spaniards from Europe are employed as unskilled labor by the Pennsylvania Railroad.

Pennsylvania State Employment Bureau reports a shortage of 25,000 workers in Pittsburgh district; men are also needed, the report says, in the bituminous coal fields to take places of miners who have not returned to work; a shortage of farm labor is noted in many sections of the state.

Wage rate of sheet steel mill operatives who are parties to Amalgamated Association of Iron, Steel and Tin Workers was reduced 1½ per cent on the base wage for September-October period; wages are based on prices of sheet steel and reflects lowered prices; July-August bi-monthly adjustment was highest in history of industry, being 108 per cent above base; September-October rate is 106½ per cent above base.

The Cost of Immigration

In a weekly letter to the members of the Inter-Racial Council, President William H. Barr called attention to the rapidly increasing arrival of aliens in this country and the prospect for an enormous influx of them following the seven years of reduced immigration and stimulated by the desire of million who wish to emigrate from Europe.

He considers that immigration will be subjected unavoidably to three obstructions, namely, the increased cost of transportation, the literacy test and limited transportation facilities. The cost of passage tickets has more than doubled. The head tax which, in 1882 was 50 cents, is now $8, and every immigrant has to pay $10 for the American Consul's vise; besides which there is a much greater difficulty in the unfavorable rate of exchange as compared with 1913, when American dollars were at par and passage rates varied from $34 from Hamburg to $48.50 from Patros as against $125 for both places, and a minimum of $98 from Genoa for all of the six ports mentioned. These differences are very much increased by the vastly larger present value of the dollar which, when translated to equivalents in foreign coins, shows an increase of more than 700 per cent on cost of tickets from Trieste to New York. Although the immigrants now earn higher wages in Europe than in 1913, the purchasing value is reduced, and increased embarkation and traveling expenses there and consular fees for each country passed through are so great that the immigrant must be already in a prosperous condition or be assisted in order to come to this country.

The literacy test was required with the expectation that it would reduce immigration, which it undoubtedly will accomplish; although many immigrants can meet it, there are undoubtedly many whom it will debar.

It has been estimated that existing shipping facilities will limit the immigration during the year commencing last April to 750,000. Although current data do not give much information regarding classification of immigrants and such information does not appear until it is quite old, the Inter-Racial Council estimates that three-fifths of the incoming, and two-thirds of the outgoing, aliens are men, which is probably a liberal proportion. From analyses of records for June, July and August, it is estimated that the net number of immigrant males was approximately 1,575 per week, amounting to only about 80,000 per year. The significance of these figures is seriously affected by the number of male aliens leaving this country, most of whom have much greater experience and earning capacity than the incoming aliens.

Recent Legal Decisions

RESERVOIR EXCAVATION HELD CHARGEABLE AS SHALLOW FLOWAGE EXCAVATION

A contract for the excavation of a reservoir provided the sum of 35 cents for the removal of the top soil, $1.48 per cubic yard for miscellaneous excavation, and 24 cents per yard for shallow flowage excavation. The New York Appellate Division holds, in an action for work done, Beaver Engineering & Contracting Co. v. City of New York, 183 N. Y. Supp. 386, that, in view of other provisions of the contract, excavation of material for treatment of the reservoir bottom should be paid for as shallow flowage excavation at the rate of 24 cents per cubic yard, particularly as previous settlements had been made on that basis and for the further reason that another construction would give the contractor much greater compensation for excavation for this purpose than excavation for material for dikes involving greater labor, which was treated as shallow flowage.

CONTRACTOR CANNOT CLAIM PAYMENT FOR UNAUTHORIZED WORK ON BRIDGE EXCEPT THROUGH LEGISLATURE

The New York Appellate Division holds, Paddleford v. State, 183 N. Y. Supp. 249, that under the State Highway Law, §2, Subd. 5, defining highways as including bridges having spans of 5 feet or less, there is no authority of any officer, board or department outside the Legislature that can audit or make payment to a contractor for the construction and improvement of a county highway who, by supplemental contract with the state commission of highways, built a 56-foot bridge over a body of water. It was not questioned that supplemental contracts can be made for additional work and material by the state commission of highways and by the division engineer representing the department; but such contract must be to supplement and for additions upon contracts which come under the jurisdiction of the highway department, such as additional stone, material, or excavation, etc., on work being done on highways defined as such by the statute. The limit here is a 5 foot bridge; there is no authority to increase that length to 56 feet and still have it within the statute. The court said: "This statute is not ambiguous. Much as it is borne in upon us that these claimants are entitled to this amount of money from the state of New York, we cannot disregard an express provision of statute to reach that end, without bringing the administration of the law into disrepute. Claimants' relief is via the Legislature."

CITY NOT BOUND BY BUILDING COMMITTEE CHAIRMAN'S UNAUTHORIZED ORDER FOR MATERIAL

The New Jersey Supreme Court, in McLean v. Mayor & Common Council of Newark, 110 Atl. 692, holds that the city of Newark is not liable for materials furnished and labor performed, or orders issued by the chairman of the public building committee of the common council of the city, where the orders were not authorized by the city nor by the committee of which he was chairman, and the common council did not ratify the chairman's action, and had not paid any similar orders. The case was held to fall within the rule laid down in other New Jersey cases, that a municipal corporation cannot be held bound, by either an express or an implied contract, in defiance of express restrictions imposed by law, as limitations on the powers of the corporate agents, through whose instrumentality the contract is sought to be derived.

AIMING TO PREVENT REMOVAL OF COUNTY SEAT HELD UNENFORCEABLE

A contractor had agreed with county commissioners for the rebuilding of a courthouse at the county seat. The legality of the contract was disputed by taxpayers and injunction proceedings were threatened. There was also a movement to remove the county seat to another town. To induce the contractor to continue the work of rebuilding, a contract was entered into with him by certain residents of the county seat to reimburse him for any loss he should sustain in his further prosecution of the work, this contract being entered into in order to rebuild the courthouse before removal of the county seat, and thus create a situation which would influence public sentiment against the change. In an action by the contractor who, relying upon this contract, had incurred certain obligations, it was held, King v. Randall, Nevada Supreme Court, 190 Pac. 979, that the contract was unenforceable as contrary to public policy.

STATUTORY BOND PROVISION AS TO SUPPLIES TO CONTRACTOR

A bond given by a schoolhouse construction contractor, which contains no clause for the payment for supplies furnished, is not the bond required by the Texas statute of 1914 with reference to public buildings, and while it may be good as a common law bond, does not bind the surety further than therein specifically stated, and therefore, the Texas Court of Civil Appeals holds, Acme Brick Co. v. Taylor, 223 S. W. 248, does not make the surety liable for supplies furnished the contractor. The contractor, however, may be sued for such supplies.

ROAD BOND STATUTE MODIFIED BY LATER ACT

Mississippi Laws, 1914, c. 176, provides a scheme for the issuance of bonds for road purposes and for working roads. Under this act a bond issue was authorized, but bonds were not actually issued when Laws, 1920, c. 207, was passed. The two acts were in conflict with respect to the method of ordering elections, and the Mississippi Supreme Court holds, Rosenstock v. Board of Supervisors of Washington County, 85 So. 91, that the latter act prevails over the former as to method, but does not avoid an election under the former, but only limits the time to one year after the passage of the later act.

NEWS OF THE SOCIETIES

October 16-19—AMERICAN COUNTRY LIFE ASSOCIATION. Annual conference, Springfield, Mass. President, Kenyon, L. Butterfield, Amherst, Mass.

Oct. 19—CORNELL SOCIETY OF CIVIL ENGINEERS. Annual meeting. New York City.

Oct. 19-22—INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. 25th annual convention, New Orleans, La. Secretary, C. R. George, Houston, Texas.

Oct. 20 — AMERICAN WATER-WORKS ASSOCIATION. New York Section October meeting. New York City.

OCT. 26-28—AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION. Convention at tlanta, Ga. Headquarters, Chicago.

Nov. 5-6 — AMERICAN WATER-WORKS ASSOCIATION. Iowa section. Sixth Annual Convention. Iowa City.

November 12—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Second Fall meeting, Chicago. Sec., 33 W. 39th St., New York.

Nov. 12—CONFERENCE ON EMPLOYMENT AND EDUCATION, sponsored by the American Assn. of Engineers. Chicago.

Nov. 15-17—CITY MANAGERS, ASSOCIATION. Annual convention at Cincinnati, O. Executive Secretary, Harrison G. Otis, 812 Tribune Bldg., New York City.

Nov. 18-19 — AMERICAN ENGINEERING COUNCIL. Organization meeting. Washington, D. C.

Dec. 7-10—AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual meeting, New York. Secretary, 29 W. 39th St., New York City.

Jan. 25-27, 1921—THE AMERICAN WOOD PRESERVERS ASSOCIATION. Place of meeting to be announced later.

May 17-19, 1921—NATIONAL FIREMEN'S ASSOCIATION. Twenty-third annual convention. Fort Wayne, Ind.

June 7-9, 1921—NATIONAL FIRE PROTECTION ASSOCIATION. Annual meeting. San Francisco, Cal.

June, 1921 — CONFERENCE OF MAYORS AND OTHER CITY OFFICIALS, State of N. Y. 12th Annual Conference. Elmira, N. Y.

AMERICAN SOCIETY OF CIVIL ENGINEERS

At a business meeting of this society held at New York on September 1, there was an animated discussion of two important propositions now before the society—Joining the Federated American Enugineering Societies, and adopting the amendments to the constitution referred to the society by the annual convention in Portland last month. Of the nearly one hundred members present, the majority were opposed to both the amendments and joining the federation.

Joining the federation was opposed because it did not seem to promise any sufficient return to the society for the prestige which it would contribute and share with organizations of much lower standing, the federation did not have any definite program commensurate with its ambitious pretensions; and the finances of the society did not warrant its payment of the eight or ten thousand dollars a year called for, together with aditional sums which would probably be called for to make up deficits.

Concerning the amendments, it was objected that they conflicted with the constitution of the society, created an expensive machinery for the nomination of officers, would tend to create and perpetuate an oligarchy in the society, and that the annual conference of representatives of sections would involve a heavy expense. The amendment relating to dues was not objected to.

The meeting requested the Board ot Directors to distribute to the corporate members, as soon as possible, the minutes of this meeting in order that they might have the benefits of the discussion in deciding how to vote upon these subjects.

AMERICAN ENGINEERING COUNCIL OF THE FEDERATED AMERICAN ENGINEERING SOCIETIES

The first meeting of the council will be held at Washington, D. C., November 18-19, 1920. Headquarters, New Willard Hotel.

At the first session there will be the appointment of temporary committees on Program, Credentials, Constitution and By-Laws, Nominations, Plan and Scope, Budget, and Resolutions.

At the second session there will be an address on Engineering Council by J. Parke Channing, chairman, and a discussion of the field of activity for the Federated American Engineering Societies.

On the second day there will be election of permanent officers, formal ratification of constitution and by-laws, reports of committees, an address by Herbert C. Hoover, president American Institute of Mining and Metallurgical Engineers, and an informal reception and smoker.

On Saturday, November 20, there will be an organization meeting of the executive board of the American Engineering Council of the Federated American Engineering Societies.

AMERICAN ASSOCIATION OF ENGINEERS

The Federal Department of the American Association of Engineers has announced the appointment of the following engineers as members of the Federal Department Council: Morris Bien, assistant director of the Reclamation Service, Washington; N. S. Thompson, chief of the electro-mechanical division, supervising architect's office, Washington; H. E. Hallborg, radio engineer, Norfolk Navy Yard, Norfolk, Va.; William B. Harrison, of the United States Engineers' office, Washington; W. C. Dean, chief of the electrical division, Bureau of Construction and Repair, Washington; W. A. E. Doying, inspecting engineer of the Panama Canal, Washington; W. C. Lemen, of the United States Engineers' office, New York; J. T. Maguire, project manager, Bureau of Yards and Docks, Washington, D. C.

It has been practically decided that the Chicago Chapter will assist in prosecuting the case of Messrs. Pihlfeldt, Young and Kushlan against officials of the city of Chicago. These three engineers, Thomas G. Pihlfeldt, city bridge engineer, Hugh Young and Max Kushlan, were dismissed from the employ of the city of Chicago as a result of a civil service trial which the chapter described in a public statement as "farcical." A suit has been instituted by the engineers to compel the city authorities to reinstate them. The Chicago Chapter has requested the national board of directors of A. A. E. to contribute $500 to the fund for this prosecution. At a recent meeting of the board of directors, this matter was referred to a committee consisting of Raymond Burnham, W. W. DeBerard and H. W. Clausen.

W. K. Eldridge of Indianapolis, in his discussion of the re-routing of street cars in Indianapolis before the Indianapolis Chapter of A. A. E. at the meeting on September 15, described the advantages of shuttle service on subsidiary lines. Mr. Eldridge declared that the public can be educated to the financial advantages of shuttle service as feeders to the main lines reaching the business section. Although such service would require passengers to transfer, the saving in operation would be considerable and it would be possible to actually improve the service on the main lines. The American Association of Engineers has opened offices in Boston at 50 Broomfield street, room 305. Fred C. Lewis is temporary managing secretary and also recording secretary.

Instructions have been received by Chairman Harold Almert of the A. A. E. building and insurance trustees from the board of directors of the association that the trustees, in making arrangements for the purchase of an A. A. E. building in Chicago to concentrate their efforts upon a building to cost about one million or one million and one-half dollars. Previous to this decision three types of buildings were under consideration; to cost three million, to cost one million or one and one-half million, and to cost one-half million.

The American Association of Engineers had 20,890 members in good standing on September 18.

306 men placed in one month is the record establishedd by the service department of the American Association of Engineers in August. Almost 3,000 men were referred to positions during the month.

At the first convention of the Washington State Assembly of A. A. E. held recently in Everett, Washington, a committee on education was appointed to arrange with state educational institutions for extension courses which can be taken advantage of by A. A. E. members in the state. The convention also recommended that county engineers of the state be appointed instead of elected, that they have full charge of road funds, and that their salaries range from $3,000 to $6,000 per annum.

The Northwestern Highway Section of A. A. E. and the Portland Press Club conducted a general excursion from Portland, Ore., to Carter Lake on Sept. 4, 5, and 6 in cooperation with the Oregon Bureau of Mines and Geology. The trip included a 45 mile auto drive around the rim of the lake. It was open to the public.

San Francisco Chapter of A. A. E. has engaged an executive secretary on a full time basis. An office is maintained in 960 Pacific Building, San Francisco.

Chapters of the American Association of Engineers in Arizona are preparing a license bill to be introduced in the next legislature.

Railroad sections of the American Association of Engineers have been notified of increases in salaries for engineering employees on the Union Pacific, the Burlington, The Kansas City Terminal, The Missouri-Kansas and Texas, the Great Western, the New York Central, the Boston and Maine, the Pennsylvania and several other railroads.

The New York Chapter has arranged to have as its guests at the United Engineers' Building, 29 West 39th street, New York, representatives of the National Headquarters of the Republican and Democratic parties in order for them to present to the association such points of their policy as they may choose, to provide a basis of opinion as to which party makes the strongest appeal from the standpoint of the engineer.

United States Senators Jos. T. Robinson of Arkansas and Jos. W. Wadsworth of New York will represent the Democratic and Republican parties, respectively.

The meeting is considered of such importance that provision has been made for it to be presided over by the heads of prominent engineering and allied societies, of whom thirty-three have been invited, including all of the great national societies, the local engineers' clubs, and others.

CORNELL ENGINEERING SOCIETY

At the annual meeting of the Cornell Society of Civil Engineers to be held in New York City, October 19, a motion will be made to change the name of the society to the Cornell Society of Engineers. This decision comes as the result of uniting all the engineering colleges at Cornell under one head. Previous to this, only graduates of the civil engineering college have been eligible for membership.

At this meeting, Dexter S. Kimball, the new dean of the combined engineering schools, will deliver an address, and Clifford M. Holland, chief engineer of the New York State Bridge and Tunnel Commission, will speak on the new Hudson River highway tunnel.

A JOINT ENGINEERS' MEETING

The New York Section of the Am. Inst. E. E., the Metropolitan Section of the Am. Soc. M. E. and the Railroad Section of the Am. Soc. M. E. will hold a joint meeting to discuss the relative merits of modern steam and electric locomotives on October 22, at the Engineering Societies Building, 20 West 39th street, New York City.

Papers will be presented by J. R. Muhlfeld, Railway and Industrial Engineers, Inc.; W. E. Woodard, vice-president, Lima Locomotive Works; A. H. Armstrong, chairman, electrification committee, General Electric Co., and F. H. Shepard, director of heavy traction, Westinghouse Electric & Mfg. Co.

SOUTHWEST WATERWORKS ASSOCIATION

At the Ninth Annual Convention of the Southwest Water Works Association, held in New Orleans, September 24, R. E. McDonnell, of the Burns & McDonnell Engineering Company, Kansas City, Mo., was elected president. Next year's annual convention will be in Oklahoma City.

ILLINOIS SOCIETY OFFERS PRIZES

The Illinois Society of Engineers has opened a competition for technical papers in the five divisions of drainage, roads and pavements, sewerage, surveying and miscellaneous civil engineering. The papers are to be from 1,500 to 2,500 words in length, a prize of $25 and a certificate of merit to be awarded to the best paper in each division.

AMERICAN ENGINEERING COUNCIL

The Council of the American Society of Mechanical Engineers has appointed the society's representatives on the American Engineering Council, the governing body of the newly created Federated American Engineering Societies. The delegates will represent the society at the organization meeting of the A. E. C., to be held at Washington, D. C., November 18 and 19.

THE WESTERN SOCIETY OF ENGINEERS

On October 20, this society will hold a joint meeting with the Chicago Section of the American Institute of Electrical Engineers for the annual lecture by Dr. Charles P. Steinmetz.

AMERICAN WATERWORKS ASSOCIATION

NEW YORK SECTION

The October meeting of the American Water Works Association, New York Section, will be held on October 20, at the Hotel McAlpin, New York City. The meeting is scheduled to begin at 12 o'clock noon and at 1:30 Mr. George C. Whipple will give an illustrated talk on "Eight Months in Europe with the League of Red Cross Societies."

AMERICAN WATER WORKS ASSOCIATION

Iowa section of the American Water Works Association will hold its sixth annual convention in Iowa City, Iowa, on November 5th and 6th. This section includes the states of Wisconsin, Nebraska, Missouri, South Dakota and the state of Iowa. The name of the section will probably be changed at this meeting.

THE FEDERATED AMERICAN ENGINEERING SOCIETIES

The Federated American Engineering Societies announces the following associations have elected to become members: Engineering Association of Nashville, American Institute of Chemical Engineers, Engineering Society of Buffalo, American Institute of Mining and Metallurgical Engineers, Society of Industrial Engineers.

A.S.M.E. ORGANIZES MATERIALS HANDLING SECTION

Four hundred members of the American Society of Mechanical Engineers have organized themselves into a Professional Section on Materials Handling and will provide primarily a common channel of intercourse between all the technical and industrial organizations co-operating in the solution of engineering problems connected with the handling and distribution of materials and products.

This Section will aim to be a bureau of information, complete in its scope, specific in its knowledge of the physical and economic conditions and unbiased in its conclusions. This will be done by having special meetings on particular subjects, meetings jointly with other sections, other organizations or associations, by taking part in all local and national problems relating to the purpose of this Section.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

The fortieth anniversary of the founding of this society will be celebrated November 5 with exercises in forty-two cities, embracing all the leading industrial centers in the United States.

Through the co-operation of the United States army, speeches will be transmitted by radio-phone, so that those delivered in Boston, for example, will be heard in San Francisco.

The New York celebration will be held in the Engineering Societies' Building. Engineering achievements in peace and in war will be recounted and the meeting will be addressed through radio-phone. The principal speakers will include Fred J. Miller, president of the society; Herbert Hoover, president of the American Institute of Mining and Metallurgical Engineers; Arthur P. Davis, of Washington, D. C., chief engineer of the United States Reclamation Service, and Arthur W. Berresford, of Milwaukee, head of the American Institute of Electrical Engineers.

AMERICAN PUBLIC HEALTH ASSOCIATION

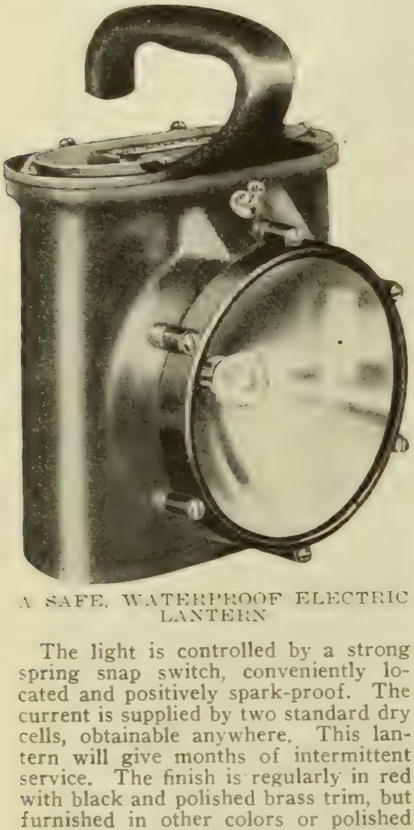
At the forty-ninth annual meeting, San Francisco, September 13-17, the principal subjects considered were Sanitation of Bathing Places, Industrial Waste Disposal and Garbage Disposal by Hog Feeding. A plan was favored for the co-ordination of Federal health activities and the eventual establishment of a Federal Department of Health with a representative in the Cabinet which was supported by H. S. Cummings, surgeon-general, U. S. Public Health Service. Officers elected were Dr. M. P. Ravenel, University of Missouri, president; Samuel A. Greeley, consulting engineer, Chicago, chairman, and Edward R. Rich, state sanitary engineer, Lansing, Mich., secretary.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

NEW LA FRANCE LANTERN ILLUSTRATED

The new LaFrance Lantern No. 1810 is waterproof and is absolutely safe to use around inflammable material of any kind. It is an ideal light for watchmen, firemen, sportsmen or automobilists. All metal parts are of brass and aluminum, accurately machined and nicely finished. The silvered reflector is large and designed to throw a wide working light with a strong, far-reaching beam for smoke, fog or long-distance work. A focussing device permits of changing the beam while the light is burning.



A SAFE, WATERPROOF ELECTRIC LANTERN

The light is controlled by a strong spring snap switch, conveniently located and positively spark-proof. The current is supplied by two standard dry cells, obtainable anywhere. This lantern will give months of intermittent service. The finish is regularly in red with black and polished brass trim, but furnished in other colors or polished aluminum if desired. A bracket for mounting is furnished at a slight extra cost. A plain bracket for the wall, truck or boat, and a special heavy brass bracket with a spring lock for fire apparatus. This lantern is manufactured by the American-LaFrance Fire Engine Company.

TROY TRAILERS

The 190 edition of the general catalog of the Troy Wagon Works Co. gives ilustrations, specifications and description of details of the standard trailers of 1, 2, 3, and 5-tons capacity having steel chassis and rubber tires. Without bodies they weigh from 900 to 4,295 pounds while the approximate weight of the bodies is from 400 to 1,800 pounds.

In their construction cast iron is eliminated and all parts are made of forged or cast steel, malleable iron or bronze. With one exception the different models are equipped with automobile type steer and drawbar which permits the truck to be attached at either end without necesitating the turning around of the trailer, a provision which is very valuable for backing and stopping the trailer.

They are equipped with automobile type knuckle axles and are steered through hinged yokes connected to the drawbars. The flexible frames, calculated to absorb shock and distortion strains, are mounted on springs shackled at both ends. The brakes, which can be placed on two or four wheels, are the expansion drum type operated by hand levers on the trailer bodies.

The one-piece I-beam axles are drop-forged and the artillery type wooden wheels have solid rubber tires with an 8,000 mile guarantee. The bearings are of high speed type. The drawbars are of telescopic construction containing powerful coil springs acting under compression whether the trailer is pulled or backed. The drawbars head provides a long spring bumper and facilitates backing.

For hauling two or more trailers in trains, they are connected by coupling links providing a universal angle adjustment for rough ground and irregularities. Bodies of various standard types are provided with flat platforms, stakes, racks, or dumping arrangements. The drop frame trailers are used with popular rolling side dump bodies operated rapidly and easily and are especially suited for hauling garbage, coal and city refuse and road-building materials.

KISSEL TRUCKS FOR ROAD BUILDING

A heavy-duty model Kissel truck will, it is claimed, haul an 8-horse truck or grader twice as fast as horses can do it and will, of course, work continuously all day long, which horses cannot do. As it operates twice as fast as teams, it accomplishes more than 16 horses and when equipped with a road-builder body with a tail gate arranged to open to any desired width and allow gravel to be uniformly spread from 2 to 6 inches deep over the roadway as the truck advances, an additional advantage of economy is effected.

AMERICAN-LA FRANCE FIRE ENGINE COMPANY INCORPORATED

During August, this company made 46 shipments of pumping engines, combination cars, trucks and tractors to cities in 15 different states. During the same period, they made sales of 62 similar items of equipment to cities in 25 different states and in New Brunswick, Ontario and Manitoba.

PERSONALS

Thomas, Carl C., has been appointed Western representative of Dwight P. Robinson & Co., New York, with offices in Los Angeles.

Lawson, Wilfrid S., has been appointed bridge and structural engineer for the Department of Railways and Canals, Ottawa.

Johnston, Major E. N., Corps of Engineers, U. S. A., in charge of work in the Wilmington District, will also take charge of work in the Baltimore District.

Banks & Craig, consulting engineers, have opened their new offices at 134 East 44th street, New York.

Eisenhardt-Conkey Co., Evansville, Ind., recently organized, will specialize in highway, drainage and mining engineering.

Burton, George L., has been appointed a member of the New Jersey State Highway Commission.

Bernhagen, L. O. sanitary engineer, has accepted a position with the city of Beaumont, Texas.

Baker, Ira O., professor of civil engineering, has been appointed acting head of the civil engineering department of the University of Illinois.

Willard, Arthur Cutts, Professor of heating and ventilation, University of Illinois, has been appointed dean of the department of mechanical engineering.

Bell, Lt.-Col. James Franklin, Corps of Engineers, U. S. A., at New Orleans, has been appointed to take charge of the Pittsburgh District.

Hicks, Craddock & McKay, recently organized, will conduct a general engineering business in Centralia, Wash.

Breed, Joshua B. F., has been appointed chief engineer of the new sewer commission of Louisville, Ky.

R. H. Beaumont Co., contractor for conveying and hoisting systems and complete power plants, has opened an office at 230 Fifth avenue, Pittsburgh, Pa., with Thomas Widdop in charge.

DAVID CHAUNCEY SHEPARD

David Chauncey Shepard, who for 46 years has been actively engaged in contracting, railroad building and engineering died at St. Paul Aug. 7. At the age of 19 he was employed in the construction of the Genesee valley canal and four years later in 1851, on the Rochester & Genesee Valley R. R. after which he was successively chief engineer of the Atlantic & Great Western, the Minnesota & Pacific, and the Chicago Milwaukee & St. Paul railroads.

During his career he built 7026 miles of railroads and in 1882-3 he built 675 miles of railroad on the Canadian Pacific line in 15 months a record which he afterwards exceeded by building 643 miles of the Great Northern Ry. in North Dakota and Montana at the rate of 100 miles per month with a force of 9,000 men and 3,500 teams.

PUBLIC WORKS.

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 49 FLORAL PARK, OCTOBER 23, 1920 No. 17

Gravel Roads: Construction and Surface Treatment[*]

By PHILIP P. SHARPLES[†]

In Maine about 88 per cent of the improved roads are gravel and practically all in Vermont, Indiana and many other states. Among states known for their high-class highway improvements, Massachusetts has about 65 per cent of its improved roads gravel, Ohio 55 per cent and the state of Washington 50 per cent. Of all of the projects which have been granted Federal aid during the past three years, more than one-quarter have been gravel roads. It is therefore important that the methods employed in constructing and maintaining gravel roads be of the highest order. And yet the subject has received little discussion as compared to other forms of improved highways. We give in this issue the views of three highway experts on the subject of gravel roads. The first, by an official of the Barrett Company, tells how to construct gravel roads and apply bituminous materials to them as a surface treatment. Another deals with specifications for such roads, and the third discusses the use of them in arid countries.

The importance of the gravel road problem is realized when the figures for Federal Aid projects are analyzed. For the years 1917, 1918, 1919, 27.67 per cent of the projects called for gravel roads. It was only exceeded by the mileage of earth roads.

Wherever good road-building gravels are available, the gravel road is the logical step between an earth road and a macadam type of road. Its usefulness depends on the gravels available, the method of using them, the care taken in providing drainage, climatic conditions, traffic, and above all, maintenance.

During the last few years attempts have been made to utilize the bituminous materials used so successfully in macadam road maintenance in surface-treating gravel roads. Naturally much of the success of these treatments has depended on the gravel roads chosen for the experiment. As in the early days of macadam treatment, the attempt has been made to save gravel roads which had so far disintegrated that a surface treatment could be of little use, or to treat roads which were gravel only in name and not in fact.

Needless to say, a surface treatment cannot supply drainage, a foundation, or modify a poor construction. Its only office is to protect, by a surface skin, the structure that lies beneath. If the skin cannot be supported, the road cannot be maintained by surface treatments.

Except in certain localities like New England and part of Texas, and scattered points in other states where a fund of practical experience has been accumulated, the bituminous treatment of gravel roads may be said to be in the experimental stage.

The importance of surface treatments is everywhere realized. A gravel road, well built of good materials and sufficiently wide to handle the traffic, can take care of two hundred vehicles per day without undue stress, if it is well maintained by the patrol system with an intelligent use of the road scraper and road drag. With an increase in the intensity of traffic, the dust nuisance becomes intolerable, and the road develops pot holes faster than the patrol men can fill them up.

Surface treatment, if it can be successfully worked, seems to hold out the only hope of holding the gravel road under increased traffic. When the cost of replacing the gravel road with some more resistant type is considered, it will be found that a very considerable annual sum can be expended on a gravel road rather than to spend the money to reconstruct it. According to the type considered, the interest on the new construction,

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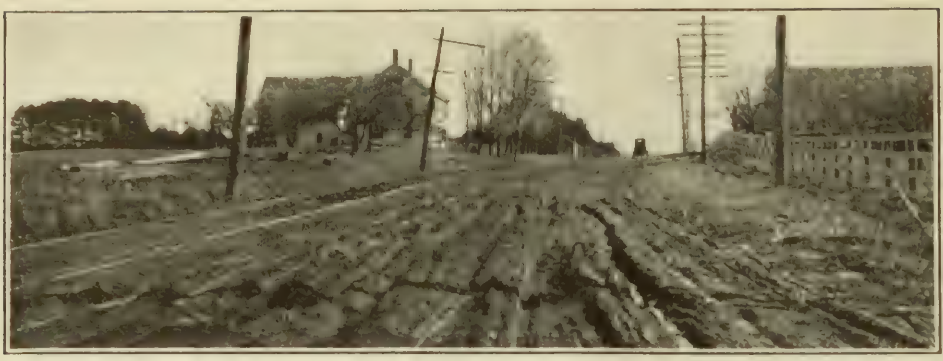
[*] Paper before the American Society for Municipal Improvements.

[†] Manager of the General Tarvia Department of the Barret Company.



AT THE LEFT IS SHOWN A GRAVEL ROAD IN MAINE AFTER THE SPRING THAW, SHOWING THE EFFECT OF FROST WHERE THE BASE IS NOT WELL DRAINED

BELOW IS SHOWN THE USE OF A DRAG IN PREPARING A GRAVEL ROAD FOR BITUMINOUS SURFACE TREATMENT

the depreciation, and the upkeep will total $2,000 to $4,500 annually, which could well be expended on the gravel road rather than to replace it.

WHEN SURFACE TREATMENT IS DESIRABLE

As long as a gravel road is giving reasonable satisfaction with good dragging and patrol maintenance, it should not be surface treated, since the maintenance by surface treatment is more expensive until the traffic reaches a point that warrants its use.

Surface treatments should never be attempted unless provision is made beforehand to insure proper patrol or gang maintenance. Their economy and success depend on proper daily care. It is less expensive to let the gravel road go to pieces in the first place than to surface-treat it and then let it go to pieces.

The application of bitumens on gravel may be divided into three groups:

The application of dust-laying oils.

The formation of a bituminous mat.

The formation of a bituminous crust.

The application of dust-laying oils may be resorted to on any type of gravel road. Subsequently, the road is maintained by the ordinary dragging and patrol methods. It must be remembered, however, that the oil destroys the natural bonding quality of the gravel and that in wet weather the oil forms an objectionable greasy mud.

The second method, the formation of a mat or carpet coat with heavy bitumens, either tar or asphalts, is rarely successful, since the mat is not thoroughly supported by the gravel surface and quickly breaks under traffic and scales off.

The third method, of forming a bituminous crust which does not form a separate layer but is anchored firmly into the gravel, has given the greatest success. In this work the refined tars used cold have been especially valuable. They penetrate into the gravels easily and harden just sufficiently under traffic to make the process successful. A material that does not harden eventually produces a wavy surface. Such a surface treatment can be successful only on a road capable of sustaining the crust under the traffic conditions imposed. Needless to say, it must be built of good gravel well drained, of proper strength and of a width adequate for the traffic. Treatments on one-track roads are not advisable. If they are adequate for the traffic, they do not need surface treatment. If they are not adequate, they should be widened.

The success of the surface treatment depends so much on the original construction of the road that it may not be out of place to give some of the principles involved.

PRINCIPLES OF GRAVEL ROAD CONSTRUCTION

Gravel in road construction should mean a material containing fragments of stone resulting from natural causes, usually water or glacial action but also in the Southern states selection by weathering through long periods of time.

The stone fragments are usually in a more or less completely rounded form and are particularly valuable in the road since they generally represent the hardest part of the country rock, since the softer parts have been destroyed in the formation of the gravel.

In selecting gravels for road work, it should be the policy to use deposits that contain 60 per cent of stone held on a ½ inch screen and passing a 2-inch screen. The best gravels have the stone well graded in sizes and the part passing the ½ inch screen is also well graded with not more than 15 per cent passing a 200 mesh sieve.

The finer or binding material may be clay, but often fine particles of other rock like trap rock make efficient binders. Sometimes iron is present in a form to make a binder. A good index of the binding quality of the gravel is its behavior in the pit. If the gravel stands in a wall it will usually bind in the road. This test does not preclude an excess of clay binder.

Clay and other slime-forming constituents must be at a minimum, not over 15 per cent for roads that are to take a bituminous surface treatment, since emulsions are formed with the bitumens and the treatment soon sloughs off in wet weather.

If the gravels are not naturally properly sized, changes may be effected by screening to remove an excess either of large or small sizes. The waste may often be utilized in the base. Over clayey soils a layer of fine sandy material will keep the clay from working up into the gravel.

Some gravels are only rendered suitable by washing, but as this is an expensive process, it is not usually possible to resort to it.

Instead of screening out the larger pebbles, it is sometimes advantageous to run the whole output of the pit through a crusher, thus utilizing everything instead of rejecting a large per cent of oversize pebbles. With the New Hampshire gravels this has been signally successful and has added but little to the cost.

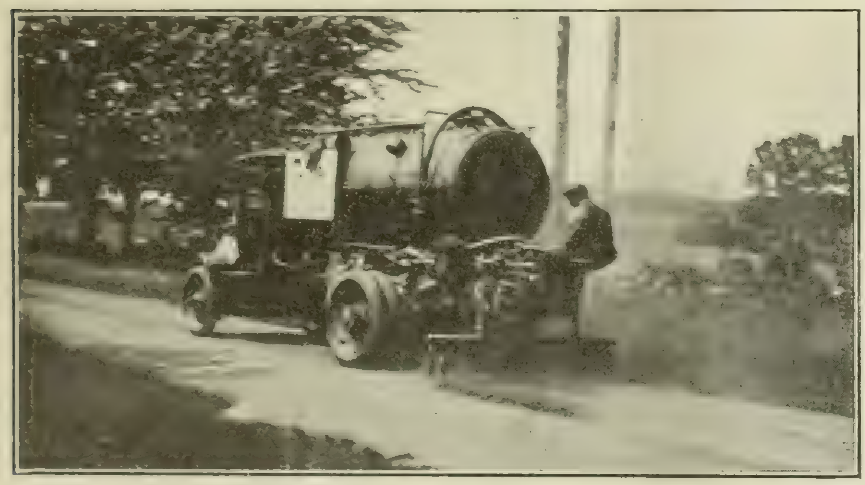
As the object in building gravel roads in most localities is to get a road of low cost not greatly in excess of a dirt road, too much modification of the gravel is not justified. Every step in the handling and transportation of the gravel should be carefully thought out and planned. With unmodified gravels, the handling and transportation of the gravel are the main items of cost in the road.

The preparation of the road bed to receive the gravel should be thorough. Drainage, good alignment and proper width should be provided. Gravel roads, it is true, are cheap roads, but satisfaction in their use depends much on making them traversable throughout the year, and safe for the traffic that goes upon them. Even more than higher type roads, they are dependent on good drainage. A road is only as good as the worst place in it.

The width of the road should be ample. The easy maintenance of the road requires that it should be wide enough to distribute the traffic. Nothing less than eighteen feet should be considered for any road that is of importance.

The road bed may be prepared to receive the gravel either by what is called the trench method or by what is called the surface method. In the trench method the gravel is deposited in a trench prepared of the width and depth required of the road. In the surface method the gravel is placed on the leveled surface and allowed to thin out on the shoulders to nothing. A combination of the two methods may also be used.

The surface method has the advantage of better protected shoulders for the same amount of gravel used.



ABOVE IS SHOWN THE APPLICATION OF REFINED TAR TO TO A PREPARED GRAVEL SURFACE BY MEANS OF A PRESSURE DISTRIBUTOR. AT THE RIGHT IS THE SAME ROAD SHOWN AT THE TOP OF THE OPPOSITE PAGE, AFTER HAVING RECEIVED A SURFACE TREATMENT OF TAR

Whatever scheme is adopted, the base should be true to line to ensure a uniform depth of gravel. The gravel should be put in in layers not over six inches to the layer. Each layer must be carefully leveled off and consolidated before the succeeding layer is applied. Methods of dumping and handling should be adopted that do not allow the gravel to lie in conical piles that are leveled off. The conical piles segregate the gravel, make it compact unevenly and produce a road that has humps throughout its life.

If different grades of gravel are produced in the pit, the best only should be used in the top layer. The specifications of the American Society for Municipal Improvements are explicit on this point and can well be followed where screened gravels are employed.

The final crown of the road should be about three-quarters inch to the foot, but where bituminous treatments are to follow, this should be reduced to one-half inch to the foot. An excessive crown on a bituminous surface tends to slipperiness and is not needed either to compensate for the wear or to shed the water quickly.

The consolidation of the gravel is often left to traffic. The best practice would indicate that rolling is necessary to consolidate the lower layer, and while the final hardening must take place under traffic yet it is much expedited by rolling. The old-fashioned horse roller built with sectional rings is particularly useful in this work.

MAINTENANCE

After the road has been opened to traffic, much care is required. Patrol maintenance should begin at once with dragging or honing after every rain. The end desired is to have the road retain the desired shape while the gravel consolidates. If the road is neglected, ruts are formed and the gravel is pushed out of shape and even out of the road.

The best way to take care of a gravel road is by good patrol maintenance. A good, intelligent man is given control of three to eight miles of road and spends his time under intelligent instruction and supervision in taking care of the stretch. He fills ruts and depressions from store piles of the self-same gravel used in constructing the road. He keeps the drainage open. He cuts the weeds and keeps the shoulders up. He drags the road after every rain. In the spring he may receive help with a grader crew to claw his road back into shape after the spring break-up.

Unless the road authorities are prepared to employ such men and encourage them, the citizens cannot expect good roads.

If the traffic becomes so great that there is a dust nuisance, and the patrolman finds it impossible to keep ahead of the pot holes, the subject of surface treatments should be considered. It is not an easy subject and if no local experience points the way, the advice of those who have successfully worked out the problem should be sought.

The refined tars applied cold have given good results on high-class gravel roads when intelligently applied and when proper maintenance is given. Gravel is not a uniform material and unless the breaks that occur are taken care of, the treatments are neither economical nor successful. The cost will be more than the usual patrol maintenance costs, but the cost of the refined tar is offset to some extent by the elimination of dragging and the saving of wear on the gravel necessitating less frequent renewals. Roads in hilly country are protected from washing, with a direct saving and economy after flooding rains.

SURFACE TREATMENT METHODS

The gravel roads are prepared for the treatment by shaping and dragging during the spring. If new gravel is added, it should not exceed a depth of two inches and should be added as early in the spring as possible. Heavy additions of gravel should be made in the fall, and new gravel roads should not be treated until they have weathered a winter and been carefully reshaped in the spring.

The road should be treated in the spring as soon as it is firm and solid. In New Hampshire and Maine, the roads are usually ready about the middle of May, but there is considerable seasonable variation.

Sweeping is usually but not always necessary. Only the dust should be removed and care should be taken not to loosen the gravel.

The refined tar is put on cold, or only warmed slightly to 100 or 120 degrees Fahrenheit. The best results are obtained by mechanical sprayers putting on two coats. The first is of four-tenths gallon, which is allowed to dry in without cover, which usually takes six to twenty-four hours in dry, sunny weather. The second coat of three-tenths gallon follows. If this is not quickly absorbed, it is covered with just enough coarse, sharp sand or fine gravel to prevent the bitumen from picking up on the vehicle wheels.

After the work has been completed, the road should be given careful patrol maintenance. Breaks will develop over soft spots in the gravel, and these must be patched with a mixture of gravel and refined tar. The patrolman should be supplied with four to ten barrels of refined tar per mile at convenient spots for this work. As soon as the first batch of weak spots has been eliminated, a good gravel road requires comparatively little attention, even under heavy traffic. The trunk highway between Portsmouth and Portland carries two to three thousand vehicles per day on this construction.

The treatment usually carries a road through the winter, but whether it breaks up during the spring depends on the road construction, the traffic and the weather conditions. After a hard, snowy winter, the road is not likely to break, but after a soft, open winter, it is quite sure to act like an ordinary gravel road.

If it does not break up, it is given a further treatment of about one-quarter gallon per square yard, and this usually requires a cover of sharp sand or small gravel, using about one cubic yard to three hundred square yards of area.

If the road breaks up, it is treated like any other gravel road—shaped up and dragged back into shape. The time when this can be done is short, and it is necessary to work quickly. If the road once hardens, ordinary road machines have little effect on the surface.

The re-shaped road is then re-treated. Usually one quarter to one third gallon per square yard will be found sufficient to restore the surface and carry it through the season.

Roads that do not in themselves break up may, after a few seasons, become rough through frost displacement or through poor maintenance. A road becoming rough should be broken up in the spring. The road roller with a steam scarifier are efficient tools for this purpose. After breaking, the road is harrowed back into shape and rerolled. It is then given a treatment of refined tar and treated like the road that has broken naturally. The refined tar in the road sticks the gravel together in chunks to some extent, and the road often is smoother and wears better than ever before.

The cost of breaking up is not excessive; in Maine it was under $200 per mile for an 18-foot road previous to the war.

The scheme which has been outlined for extending the usefulness of gravel roads must not be misunderstood. It does not produce roads which are capable of standing the punishment of higher-class roads. They are not adapted to heavy, all-the-year-round traffic, but they are adapted to a light winter traffic and during the summer will stand up under heavy touring traffic.

Where heavy winter and spring traffic exists, this type of road will not answer, and macadam, bituminous macadam, or even a more expensive type, will prove more economical.

If, however, the gravel road can be made to stand the traffic by an expenditure of even $1,000 to $1,200 per mile per year, it is justifiable, rather than to build a higher type at prevailing prices and high interest rates. A $20,000 per mile type costs yearly in the neighborhood of $2,500 for interest, depreciation and upkeep; and a $40,000 per mile type may be rated at $4,500 per year for the same charges. From these figures, road engineers are justified in giving close study to the problems of the cheaper class of roads. The road propagandist has made many an engineer forget that even under the most favorable conditions the gravel road mileage built is going to exceed, for years to come, that of any other type of surfaced road.

Gravel: A Plea For Common Sense Specifications

By Wallace F. Purrington*

The author believes that gravel is found with such variable characteristics, and that expensive sorting is so impracticable, that field inspection of the gravel by the engineer is more reliable for securing good roads than any possible laboratory tests of samples. He submits specifications based on this idea.

In drawing up any specification to cover gravel used in road construction, there are certain facts which must be kept in mind. The foremost question of all is, are the specifications workable? A theoretical specification based on laboratory findings alone may be very impracticable in the field, owing to the fact that the deposit from which the samples were collected is not homogeneous, so that the samples tested do not fully or accurately represent any large part of the deposit. In the second place, specifications may work well or badly according to whether or not the purchaser has the equipment or technical knowledge to check up the different items of composition in the specification.

At the present time most specifications covering gravel are(to the writer's mind) very ambiguous and wholly impracticable to put into operation. Many states make a practice of using screened gravel, but for the expense involved and the results obtained, New Hampshire, and it has many miles of very good gravel road, has found this procedure unnecessary. If the manipulation of run-of-bank gravel is properly supervised, the results obtained are equal to those with the screened material. In the first place, gravel usually is defined as the material passing a 3½-inch screen; then a ¼-inch screen is interposed and two distinct sizes of material are separated. The material retained on the ¼-inch is arbitrarily called gravel or coarse aggregate and the material passing it is called sand or fine aggregate. Specifications commonly attempt to set limits to the ratio of gravel to sand which shall be such as to guard against the gravel being too sandy on the one hand or too cobbly on the other. This might be very satisfactory if gravel deposits were generally uniform and homogeneous in texture; but that is not the case, the gravel deposits which are most abundant and accessible all through the Northern states, deposits left by flooded rivers during the closing stages of the Ice Age, are notably heterogeneous in structure and texture. The long, narrow ridges or "eskers" of the New England states, and the shorter, interrupted ridges and hummocks of gravel, called "kames," show abrupt variations in the deposit, from the fine sand to coarse, cobbly gravel, both in vertical section and lengthwise; so that a sample taken at one level or at one point may give a very incorrect idea of the average run of gravel from the face of the bank, and is no guide whatever to the quality of material that will be found 50 or 100 feet farther in. These banks were built by rivers running through and out from the melting ice sheet, where great floods during warm days or weeks alternated with sudden droughts when severe cold waves checked the wastage of the glacier. This spasmodic behavior of the glacier rivers accounts in large measure for the variability of the material in most "bank" gravels. Even the wash plains and valley-terrace gravels which accumulated beyond the reach of the ice sheet show too much variation in texture, both vertically and horizontally, to yield samples that would afford an adequate basis for judgment in the laboratory of what can so readily be seen in the field. A demonstration of this fact, by a study of scores of samples from a single deposit, has been given by Reinecke and Clarke in a paper entitled "The Sampling of Deposits of Road Stone and Gravel in the Feld," and published in the Proceedings of the American Society for Testing Materials, Vol. 18, part 2, 1918. Their conclusions were summed up as follows:

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*Chemist and Testing Engineer, State Highway Department, Concord, N. H.

"A large variation was found between results of duplicate granulometric laboratory analyses on the same sack of gravel. The variation in texture over one deposit of gravel of 800 acres was found to be large."

An inspection of almost any bank in New Hampshire will illustrate the truth of the foregoing statement, and the futility of depending upon a single sample or many samples to pass judgment on a given deposit. The desired result is far more likely to be gained by making the texture (coarse or fine) and grading (uniform, streaky, etc.) matters for field inspection by the engineer in charge, and leaving the laboratory to test only the resistance-to-wear of the gravel. Assuming then that the material is composed of hard, durable stones, the rather over-worked phrase, "such as will meet the approval of the engineer," can be well used. This means more for the proper construction of gravel roads than any theoretical grading system that may be adopted.

In New England and the Northern states, three sorts of material usually compose the gravel pavement of a road; gravel, sand and till (which last is commonly called "hard pan"). According to the proportion in which two or more of these are combined, such roads should be designated as "sand-gravel," "till-gravel," or "sand-till-gravel" road. The choice as to which type of gravel road is to be built will depend largely upon the material found in the sub-grade. The finer material is added to fill the voids in the coarse aggregate, and acts as a binder. The state, being the purchaser, may well tell the contractor whether clay, till, or sand shall be used. It might also say that the base course shall be of gravel, the larger stones predominating, and that the wearing or top course shall be such that much smaller stones shall predominate. This sort of statement is comprehended by all parties interested. The engineer, inspector, contractor, or government representative has an intelligent basis from which to draw conclusions and a far more honest statement than could be obtained by a chance sample showing that 59 or 63 per cent is retained on a ¼-inch screen. Such a specification is not only misleading, it is positively absurd.

The soundness or durability of the stone comprising the aggregate is, however, a matter of considerable importance. Fortunately, we have a rational method of gauging this in the Rea modification of the DeVal abrasion test as described in the Bureau of Public Roads Bulletin No. 555, page 30. By this test it is possible to place certain arbitrary values which ordinarily should not be exceeded.

A few outstanding facts will serve to summarize what has been said concerning gravel specifications: (1) The greatly increased demand by the public for good roads cannot be met, in every community, by adopting the heavier and more costly types of construction. Gravel and earth roads must still be very generally built, and local materials thus used. As the item of screening of gravel is quite costly we may well consider its elimination, as the question of its efficacy is open to question. (2) Specifications for the material to be put into such gravel roads must be plain and straightforward; so far as grading is covered, the specifications must be based upon what a reliable engineer sees at the pit where the deposit is fully exposed; not based upon the laboratory screening test of a sample or a group of samples, from a deposit which in all probability varies greatly in texture. (3) A laboratory test of the per cent of wear of the coarse aggregate, according to the Rea-DeVal test, should be made a part of the specification, to insure that the material consists of sound, durable stones. (4) The character of the fine aggregate or matrix should be left to the judgment of the engineer. (5) A little theory mixed with a lot of common sense, is better than the reverse.

With these points in mind, after conducting an extensive field and laboratory survey of gravels, the state of New Hampshire has adopted the following specifications:

MATERIALS FOR GRAVEL PAVEMENT

Gravel is to be understood to be a water-laid, stratified deposit which consists of rolled and rounded stones accompanied by sand and clay in varying proportions. The stones (or coarse aggregate) shall be hard and sound and well assorted, in sizes up to but not exceeding three and one-half (3½) inches in long diameter. The resistance to wear shall be determined by the modified abrasion test described in Bulletin 555, page 30, of the U. S. Department of Agriculture, Office of Public Roads; and the gravel thus tested shall be classified as follows:

Class A, Hard gravel under 7 per cent wear.

Class B, Medium hard gravel from 7 to 10 per cent wear.

Class C, Medium soft gravel from 10 to 15 per cent wear.

Class D, Soft gravel above 15 per cent wear.

Classes A and B may be used for either or both base or surface course. Class C will not be used for surface course and gravel of D quality will not be used except by written permission of the Commissioner.

The texture (coarseness or fineness) of the aggregate from any source or supply of gravel shall be such that it shall meet the written approval of the Commissioner. No gravel shall be used until a complete report has been made by the Engineer regarding its qualities, and the approval of the Commissioner has been obtained specifying the class of work for which its use is approved. The approval shall be furnished on a form which shall contain the following information

1. Account to which work is to be charged. . . . . .
(Town)
2. Nature of material, gravel, sandy gravel, sand, till, clay
3. Source of material . . . .
(Local name) (Location)
4. Type of material, gravel, gravel till, gravel clay, sand-clay.
5. Contractor or Foreman . . . .
(Name) (Address)
6. Grading of pit (Visual inspection) (Check the description which best fits the case.)
   (a) Uniform and well graded, large stones predominating.
   (b) Uniform and well graded, small stones predominating.
   (c) Streaky or poorly graded, coarse aggregate predominating.
   (d) Streaky or poorly graded, fine aggregate predominating.
   (e) Sandy with only a small amount of coarse aggregate.
   (f) Cobbly with only a small amount of fine aggregate.
7. The Laboratory has reported on a sample submitted from this source under Laboratory Number. . . . . . . .to be. . . . . per cent of wear and is rated as Class. . . . . .gravel.

. . . .
Engineer.

This is satisfactory material and may be used in the base, surface course.

. . . .
Commissioner.
By. . . . .

These blanks shall be executed in quadruplicate, one copy to be furnished the contractor, one copy to the Office of Public Roads, one copy to the Commissioner and one copy to be retained by the Engineer.

It is understood that the Engineer may order the Contractor to cease operation in any pit when in his judgment the size of aggregate is not suitable for the type of road construction under consideration.

Gravel Roads in Arid Country

That a gravel road, being water-bound, should not be laid in an arid country, but that sand-clay is better for such conditions, is the opinion of Lamar Cobb, for six years state highway engineer of Arizona

To build a water-bound pavement in a country where nature furnishes no water would appear to be self-evidently impracticable and unreasonable, and yet such roadway surfaces are being built in the arid sections of our Southwest. This matter was discussed in a communication sent to this paper recently by Lamar Cobb, who was state highway engineer of Arizona from 1912 to 1918 and who has had an experience of more than ten years in highway work in both arid and non-arid climates, but especially in the former. The following is a more or less abbreviated statement of the points brought out by Mr. Cobb.

The effect of low precipitation—from 2 to 25 inches of rainfall annually—on the life and maintenance of water bound road surfaces in the arid and semi-arid sections of the Southwest has not received proper consideration by highway engineers. Water-bound roads include not only water-bound macadam, but also gravel, sand-clay and native soil. Water used in constructing and that supplied by rain or atmospheric moisture, tends to evaporate and be absorbed by the ground below, the length of time that the moisture is retained and performs its functions as a binder being dependent upon the aridity of the climate. A water-bound gravel road in an arid climate cannot be maintained by the use of the grader or drag, since there would be no moisture for reconsolidating and recementing the earth and other fine matter which serves as a binder. The surface soon becomes roughened by the removal of the clay and small stone by winds and vehicles. It can be resurfaced only by periodic scarifying or ploughing, harrowing and reshaping during the winter season, consolidation being effected by traffic, for the expense of sprinkling and rolling would be prohibitive.

The idea sometimes suggested of sinking wells and using the water for supplying the moisture required to bind such roads is impracticable, even were the water obtainable at reasonable depths, for there would still be no moisture in the sub-base or in the base, and consequently to keep the surface moist it would be necessary to sprinkle it continually, the cost of which would be impossible.

In such a country a gravel road will not last more than one or at most five years, and yet many miles of such roads are now being constructed and paid for by thirty-year bonds. Highway engineers are becoming well acquainted with the highly objectionable features of issuing bonds having a longer life than that of the road to be constructed by the proceeds from them.

In the East, water-bound macadam and occasionally gravel are used to advantage as base for a comparatively thin wearing surface of bituminous material or brick, but such construction would be an unnecessary expense in arid sections, according to Mr. Cobb, since no sub-base is necessary, there being no water in the soil to soften it, but the whole sub-base being one homogeneous, unyielding stratum.

The greater the proportion and the smaller the size of the fine binding material in a road surface in arid countries, the longer will this surface retain moisture, and the more readily can it be maintained. This being the case, for such a climate a sand-clay road with its 30 per cent of clay binder and 70 per cent of sand is more suitable than a gravel type of road with 10 per cent clay binder and 90 per cent gravel. The sand-clay road will wear more rapidly but furnishes at all times a smooth riding surface, which the gravel rarely does for longer than one year. Gravel roads are being built in the Southwest at a cost of approximately $10,000 per mile, while a sand-clay road can be built for half that sum, or less. Moreover, where gravel deposits are found, there is likely to be also both sand and clay, either separate or mixed in approximately the right proportions. There are miles of roads traversing sand-clay country where it is only necessary to install the necessary cross-drainage structures and crown up the road to a higher grade or, in the case of low ground, surface with high-ground materials to be found near at hand.

Neither sand-clay nor gravel will be durable in or near villages or other centers of population. But the considerable amounts saved by constructing sand-clay instead of gravel in the country districts will be sufficient for constructing a more durable type of pavement within and for the first mile or two outside of the towns and villages which the roads connect.

Gravel Roads in West Virginia

Following a recent inspection of Federal aid projects in several counties of West Virginia, B. E. Gray, senior U. S. highway engineer, said that he found excellent gravel surfacing 10 inches thick being put on at 50 cents a square yard. It is planned to give this gravel oil treatment in 1921, at a cost of 15 cents a square yard, which will give a road surface adequate for local conditions and which compares most favorably with other types costing considerably more than 65 cents.

Kansas Must Legislate For State Roads

On account of a provision in the Constitution of the state of Kansas whereby "the state shall never be a party in carrying on any works of public improvement," an amendment has been prepared and will be voted upon November 2, permitting the state to extend aid amounting to 25 per cent of the cost of building roads, provided the aid extended to them shall not be in excess of $10,000 for each mile of road built.

It is expected that such state aid will not involve state taxation but will be derived from motor car license fees. This amendment is stated to be the only measure by which the entire state of Kansas may receive material aid in good road building and should the amendment fail on this vote it is doubtful if the next legislature would take it up again.

Restricting Motor Truck Traffic

The public service commission in Philadelphia has recently refused to issue convenience certificates permitting heavy trucks to use the Lincoln Highway between Philadelphia and New York because that thoroughfare is already badly cut up by these heavy vehicles and it is believed to be questionable whether they should be permitted to travel over it. An investigation is now being made of the conditions of the roadway and of the corporations or individuals operating on it without a license, which will probably lead to regulation of the weight of trucks permitted. Until this investigation is completed, no more certificates of convenience will be granted for the operation of any motor trucks on the Lincoln Highway between Philadelphia and Trenton.

Surfacing Old Cobble Pavements

Describes how Danville, Va., prepares its old cobble streets for surfacing and applies a mixture of asphalt, stone and chips, securing a smooth pavement at a total cost of about 65 cents a square yard.

Despite the high price and scarcity of cement and other building and paving materials, Danville, Va., is securing some very good pavements at extremely low prices. Danville is an old city and has about ten miles of streets paved years ago with cobble stones. Under the direction of Ralph K. Linville, the city engineer, these cobble pavements are being turned into smooth and durable ones suitable to all but the heaviest traffic of the city. The cost of this averages about 65 cents a square yard for the completed work. Mr. Linville considers that only about half of the ten miles of cobble streets can be treated satisfactorily in this way without costing considerably more than this, and this resurfacing is being done on only those streets which are of even contour, fairly smooth and on light grades.

The first work of this kind was done last November, soon after Mr. Linville became city engineer, and is therefore a little over seven months old. It is at present in very good shape, the only objectionable feature evident being softening and creeping during hot weather, which is probably due to the use of asphalt with too high penetration—130 to 150. On more recent work the penetration has been lowered to 100 to 120 and on these streets this trouble has not developed.

The old cobble streets have their joints pretty well filled with an accumulation of dirt in which more or less grass and weeds are growing. In preparing the pavement for the new surface, the grass and weeds are carefully removed, all loose dirt is swept off, and the pavement is then thoroughly washed with a fire hose under city pressure. This washing removes the sand and dirt from the joints between stones to the depth of about an inch, furnishing a bond for the surface treatment. After the street has dried out it is covered with a coat of half-inch to inch stone which is spread and raked to an even surface and then lightly rolled. On this is applied a coat of Burmudez asphalt, using about three-quarters of a gallon to a square yard, which is immediately covered with a coating of stone of one-quarter-inch to three-quarter-inch size, which is spread thickly enough to take care of the surplus asphalt and leave a small amount of loose stone in addition. This fine stone is thoroughly rolled and a second coat of asphalt of one-half gallon to the square yard is then applied and immediately covered with a coating of stone chips sufficient in quantity to take up any excess asphalt, and the street is again thoroughly rolled. This gives a smooth pavement with a minimum thickness of about an inch over the cobble stones.

The pavements built in this way and now in use closely resemble asphalt macadam. The undisturbed cobble stones which have carried years of traffic give a solid foundation. The work is done with city forces and has averaged a little over 65 cents a square yard, with stone costing $4 per yard.

Mr. Linville does not expect these pavements to last under heavy traffic but believes that they will last two years or more in outlying or residential sections where the traffic is light, before needing resurfacing or substantial repairs, and that they give a very decided improvement at low cost.

Better Highways For North Carolina

A large and enthusiastic meeting was recently held in Wilmington, N. C., under the auspices of the Chamber of Commerce, Kiwanis Club, Rotary Club and the president of the North Carolina Good Roads Association, at which a very strong plea was made for the governor and legislature of 1921 to provide necessary ways and means for laying out, constructing and maintaining a modern system of highways, interconnecting and interjoining the county seats and principal towns of the state.

It was shown that the state has taxable property amounting to three and one-half billions, banking resources of about 400 million dollars, and agricultural crops of more than one and one-half million dollars last year and that the present system of roads is so bad as to amount to the imposition of an annual mud tax of 100 million dollars. It was estimated by one speaker that, if the railroads were required to improve their lines 100 per cent and the necessary highways were built to support them, the shipments of manufactured and farm products during the next ten years would double the state wealth.

Progress on Iowa State Roads

The latest report of the Iowa State Highway Commission shows that notwithstanding the very great obstacles that Iowa, in company with other states, has experienced in road building this season on account of scarcity of labor and materials, there has been completed this year 14.1 miles of paving on Federal aid road building projects which total 137.9 miles of paving. There has also been completed 20 out of 150 miles of gravel road and 283 out of 556 miles of grading.

Especially good progress was made in July, when there were completed 6 miles of paving, 11 miles of graveling and 44 miles of grading. Scott county is considered to lead in having let two contracts, each of them for more than 5 miles of brick paving. The paving is being done with wet concrete hauled to the sites from central mixing plants. Throughout the state large use is made of mechanical road building equipment.

The A. S. M. I. St. Louis Convention

Narration of the doings of the twenty-sixth convention of the American Society for Municipal Improvements. Discussion of the society's finances results in increase in dues. Change in system of committees. Reports of committees on paving specifications.

A program apparently adjustable to fit the conditions, an entertainment committee so thoroughly organized that everything went like clockwork, audiences of comfortable size and reasonably prompt in gathering and perfect weather joined to make the St. Louis Convention of the American Society of Municipal Improvements one of the most notable in its history. About three hundred members and guests signed the convention register.

The program, printed a month before the convention and carried out almost to the letter, had three or four outstanding features.

The session of Tuesday afternoon was rather miscellaneous in its nature and had papers of interest to almost all classes of members. That of Wednesday morning was a gathering of the experts in sanitation, sewage and waste disposal and sewer construction, the advances in the activated sludge process being brought out in particular in the papers by Langdon Pearse, of the Chicago Drainage District; Edward Bartow, formerly of the Illinois State Water Survey, and discussion by T. Chalkley Hatton, of Milwaukee, and J. C. McVea, of Houston, Tex. Wednesday evening was a notable program for the City Planners and drew an attendance of St. Louis citizens interested in the work of that city. St. Louis, Washington, Pittsburgh and the replanning and reconstruction of French cities and towns received most attention.

The long program of papers on paving was almost completely cleaned up in the two sessions of Thursday, including the discussion and passing to letter ballot of a few changes in the standard specifications and some new specifications for curb and gutter.

Traffic and transportation were covered on Friday morning by Prof. A. H. Blanchard's report and papers by Henry G. Shirley on the proposed uniform vehicle law, by Robert Hoffman on widths of roadways on various classes of streets and roads, and by R. C. Barnett on the relations of pavement foundations and economic transportation.

The officers elected were Col. R. Keith Compton, of Baltimore, president; E. S. Rankin, of Newark, first vice-president; W. W. Horner, of St. Louis, second vice-president; E. R. Dutton, of Minneapolis, third vice-president; Charles Carroll Brown, of Valparaiso, Ind., secretary, H. H. Smith, of Brooklyn, N. Y., treasurer; Frederick A. Dallyn, of Toronto, C. Arthur Poole, of Rochester, and S. Cameron Corson, of Norristown, Pa., finance committee.

Baltimore was chosen for the next convention.

SECRETARY'S REPORT

The report of the secretary showed some growth in the society, the number of members being 612; the society having recovered to the same membership and receipts of money as in 1916, before the intermission caused by the war. The general expense of operating the society has been decreased in the four years, but the cost of printing has increased so much that the total cost of operating the society for the year was about $1,650 more than the receipts. The bids for next year's printing being considerably greater than for this year even, it was deemed necessary to increase the dues 50 per cent to prevent an actual indebtedness or a serious reduction in the character of the service to members, and an amendment to effect this was adopted.

Inspecting the secretary's report more in detail, we find that during the year from September 30, 1919, to September 30, 1920, there were admitted to the society 78 active members, 7 affiliated members and 45 associate members, while there were lost during the year 47 active, 5 affiliated and 11 associates; giving a total membership at the end of the year of 457 active members, 24 affiliated and 130 associate.

The receipts of the society comprised $1,764.50 active members' dues, $97.50 affiliated dues and $972.30 associate dues; $252.23 for Proceedings sold; $28.37 for specifications sold; $652.81 for advertisements, and $4.11 miscellaneous; to which should be added $31.87 interest on Liberty Bonds owned by the society.

The expenditures included $128.75 for office stationery and printing, $15.71 telegrams and exchange, $180.47 postage, express and freight, $600 for office clerk, $10.50 treasurer's expense, and $15.15 for office supplies; a total of $950.58 for office expenses. For convention expenses there were paid out $504.41; for specifications $56.50, and for publishing and sending Proceedings $2,496.31. The society still owes the printer $1,330, and the secretary's salary of $300 was not collected during the year. Aside from the printing of the specifications, most of the items of expense are less than last year, while the receipts were nearly $500 greater than last year and about $1,000 more than in 1918. However, the cost of printing and distributing the Proceedings, including the advance papers, was so much greater that the total expenses considerably exceeded the year's income. A comparison of the expenses and income for the four years past was made by the secretary in the following tabular form:

Comparison of Expenses and Income for four years:

	1916-17	1917-18	1918-19	199-20
1. Total Expenditures	$4,461.99	$2,061.39	$3,848.74	$5,637.80
2. No. of members	606	543	544	612
3. Total expense per member .	7.36	3.80	7.07	9.21
4. General Expense	2,474.69	1,311.28	2,183.34	1,811.49
5. General Expense per member	4.08	2.42	4.02	2.96
6. Cost of Proceedings and Advance Papers	1,987.30	750.11	1,662.46	3,826.31
7. Cost of Proceedings and Adv. Paper per member	3.28	1.38	3.05	6.25
8. Income from dues	2,860.10	2,120.20	2,482.00	2,835.30
9. Income from dues per member	4.72	3.90	4.56	4.63
10. Other income	1,536.87	629.26	804.07	937.52
11. Other income per member..	2.53	1.16	1.48	1.53
12. Total income per member...	7.25	5.06	6.04	6.16
13. No. of pages of Proceedings.	740	240	448	726
14. Cost per page	2.69	4.38	3.71	5.27
15. Cost per copy (750 copies printed) including Advance Papers	2.65	1.40	2.22	5.10

This year the cost of printing the Proceedings, including typesetting, paper and presswork complete, averaged $2.15 per page, while the cost for printing the 1920 Proceedings will be $3.54 per page, including 50 cents per volume for binding. Assuming the same number of pages in the volume as this year, the Proceedings for 1920 will cost about $3,300 and there would be a deficit next year of between $2 and $3 per member. It was to meet this anticipated deficit that the dues were increased 50 per cent.

AMENDMENTS TO CONSTITUTION

Another amendment to the constitution introduces a complicated system of sub-committees under chairmen who are members of a general committee covering several related subjects. Thus the committee on street paving, sidewalks and street design, street maintenance and street railway construction will have 13 members, five of the general committee and two additional members in each of the four sub-committees on street paving, on sidewalks and street design, on street maintenance, and on street railway construction. Also the city planning committee will have 13 members with four sub-committees on local subdivisions, on zoning, on utilities, and on parking and open spaces; the committee on street cleaning, refuse disposal and snow removal will have 10 members with three sub-committees on street cleaning, on refuse disposal and on snow removal, and the committee on sewerage and sanitation has 10 members with three sub-committees on sewerage, on sanitation, including sewage disposal, and on public comfort stations. The other eight general committees remain as at present with three members each. The committees on specifications were increased by two, one on foundations and sub-grades and one on street railway pavements, including track construction.

The resolutions adopted included one regarding M. J. Murphy, of St. Louis, the first president of the society, who died on Monday preceding the opening of the convention at the age of 87; one to promote the membership of the United States in the Permanent International Association of Road Congresses; one approving the salary schedule for engineers in municipal employment adopted by the American Association of Engineers, and one commendatory of the committee on convention arrangements and its sub-committees for its most successful work in preparing for the convention and the perfection in its plans and in their fulfilment.

PAVING SPECIFICATIONS

The changes in the specifications for sheet asphalt pavements were presented practically as printed in the Advance Papers and make small changes in the requirements as to penetration tests, shaping and compacting foundations and wearing surface, on old foundations, methods of laying, plant for laying and testing. The committee recommended that next year's committee consider codifying the specifications to reduce their length, complexity and detail.

The committee on bituminous macadam, bituminous concrete, and asphalt block pavements recommended that the specifications for asphaltic cement in all the standard specifications for bituminous pavements be made uniform as to origin, general properties, and tests, with variations in certain details according to class of pavement and use of it, both as to asphalt and as to tar; that the various specifications for asphaltic or bituminous concrete be joined in one with variations with class and use, which can be done under present conditions.

The committee on broken stone and gravel roads made no recommendations of changes.

The committee on brick pavements presented changes providing for adequate sub-grade, underdrainage, for setting castings of sewer appurtenances on concrete foundation and not imbedded in it, for sand-cement cushion where properly graded sand cannot be obtained, the mixture to be 1 of cement to 4 of sand and 1 inch thick. A specification for asphalt filler of joints to be applied by squeegee was added.

The committee on cement concrete pavements made a few changes in the tentative specifications presented at New Orleans in 1919 and printed in the Proceedings of that year. The principal changes were in omitting the specifications for determining voids in aggregates, omitting the specification for sub-grade, that being left for the new committee on specifications for foundations and sub-grades, and omission of the entire specifications for a two-course pavement.

The committee on wood block pavements recommended an additional specification for special pitch filler to be used when bituminous cushion is used, which was printed in the Advance Papers.

The committee on sidewalk and curb specifications recommended for adoption the specifications for sidewalks adopted by the American Concrete Institute and printed in the Proceedings for 1919.

All the above specifications and changes in specifications were referred to letter ballot of the society.

The committee on sidewalk and curb specifications also recommended specifications for stone, concrete and pre-molded concrete curb; the stone block pavement specifications committee recommended specifications for "Durax" paving blocks and pavement made from them and some changes in details of the existing specifications, which were referred back to the respective committees under the rules for publication in the Proceedings of the 1920 Convention and further discussion during the year and action at the convention.

The committee on sewer specifications presented specifications for materials for sewer construction for printing in the 1920 Proceedings and action at the next convention. They are Part 1 of the full specifications; Part 2, devoted to specifications for methods of sewer construction, to follow.

The committee on foundations presented the specifications for old and new macadam base, printed in Advance Papers, which were passed to letter ballot and tentative specifications for asphaltic concrete base and cold-penetration tar base, which will be printed in the 1920 Proceedings.

(To Be Continued)

Detroit Bridge Contract Modified

The city council of Detroit, Mich., has modified the form of contract for the Belle Isle bridge, bids for which were to be received on October 2. In view of the changes, the date for opening bids has been postponed to October 30. The modifications provide for a payment of 80 per cent of the cost of the materials for the bridge as soon as they are delivered on the job, and the payment of 90 per cent of the contract price upon the completion of each part of the work. It is believed that this should result in lower bidding. If this amendment had not been made, the contractor would have had to count on approximately $3,000,000 paid for materials being tied up for several months.

Jersey City Water Department Strikers

Twelve trench diggers employed by the water department of Jersey City, N. J., went on strike a few days ago for an increase of pay from $5 to $7 a day, but after remaining out three days asked to be re-employed and were permitted to return by Commissioner Fagen.

Big Standpipe For Portland, Oregon

Plans for a new 1,000,000 gallon standpipe to be erected in the Vernon district were filed with the building department by Chief Engineer Randlett of the water bureau. The standpipe is estimated to cost approximately $100,000, the contract having been let to the Chicago Bridge & Iron Company. It is expected that the new standpipe will be completed shortly after January 1.

The new water tank will replace the present 350,000 gallon Vernon standpipe, which will be moved to the St. Johns district, according to City Commissioner Mann, in charge of the water bureau.

Septic Tanks For Unsewered Districts

By C. Edward Keefer *

A considerable area recently annexed to Baltimore is without proper sewerage, and it is impracticable for the city to extend its sewerage system to all parts of it at once. It has therefore planned septic tanks such as are described in this article as standard temporary substitutes until the several sections can be served by the city's sewers.

The city of Baltimore in 1919 was enlarged from an area of 32.19 square miles to 91.93 square miles by the annexing of territory, a considerable area of which was not provided with sewerage. In the annexed territory there are many streams, both large and small, and the natural inclination in the past has been to dispose of the house sewage by discharge into these streams regardless of consequences. One of the foremost problems of the Sewer Division of the city since annexation has been improving the conditions thus created. In conjunction with the Department of Health, it has taken a decided stand in the matter, and wherever houses are not connected with the main sewerage system of the city but discharge their sewage water into the streams, to the detriment of the public, it will be insisted that some satisfactory method of sewage treatment be provided.

It is impracticable to immediately extend the city's sewerage system into all of this new territory, and to meet the situation the Sewer Division has designed a septic tank, various sizes being provided for units of from 10 to 1,000 persons. Buildings have been constructed during the past year, and apparently will continue to be, at such a rate that quite a number of these tanks will have to be provided. They are considered to be temporary only and will be abandoned later when the necessary trunk and lateral sewers have been built for conducting the sewage to the sewage treatment plant of the city.

In studying the problem of tanks for these small installations, much thought was given to the relative advantages and disadvantages of septic and Imhoff tanks. Experience at the Baltimore sewage disposal plant, which agrees in general with conditions elsewhere, has been that a great deal more supervision is required over Imhoff tanks than over septic tanks. With the best of supervision, Imhoff tanks are often very erratic, and with little or no supervision it is impossible to predetermine the results, and it is not expected that these small tanks will receive more than a casual supervision from the owner, although the city will do its best to keep in touch with the operation of them. Occasional analyses will be made of both the influent and effluent, soundings will be taken to determine the quantity of accumulated sludge, and the sludge will be pumped into tank wagons and carted away when necessary. Sludge from Imhoff tanks is more readily disposed of than that from septic tanks, but as it is to be carted away, this removes one of the chief reasons for using Imhoff tanks. Furthermore, Imhoff tanks practically always are more expensive to construct, as the excavation has to be carried to greater depths, the details are more complicated, and a tank with more capacity must be provided.

In the Baltimore design, the larger septic tanks are based on a minimum flow of 80 gallons per capita per day, a detention period of 8 hours with a foot of sludge in the shallower end of the tank, assuming an operating period of 18 out of 24 hours. The outlet end is made shallower than the inlet so that less sludge will be carried out with the effluent because of the flotation by gas from the bottom sludge; the grade from the outlet to the inlet end varying from 4.4 per cent. to 16.6 per cent, the latter not too steep to permit a man standing up on it without slipping.

Tanks designed for more than 200 persons have two compartments, but otherwise the proportions of the entire tank are similar to those of the smaller, but the middle partition wall divides it into two tanks, each of which is twice as long compared to its width as in the case of the single tanks. In these double tanks, both compartments will be in operation under ordinary conditions, but one will be cut off during cleaning periods. The general proportions vary from a minimum of 6 feet long, 4 feet wide, 5 feet depth of sewage at the outlet end and 6 feet at the inlet end for ten persons, to a maximum for 1,000 persons of 46 feet long, 14 feet wide, 8 feet deep at the outlet end and 10½ feet at the inlet end.

The sewage enters through a 6-inch vitrified pipe, there being just inside the wall of the tank a T with the branch pointed downward and a plug in the end, which plug can be removed for the purpose of cleaning the pipe. Two and one-half feet from the inlet end of the tank is placed a wooden baffle across the tank extending 2 feet below the level of the sewage and 1 foot above it. Two and one-half feet from the outlet end is another baffle extending 1½ feet below the sewage level and 1 foot above it. The effluent leaves through a 6-inch vitrified T with the branch horizontal and attached to the outlet pipe, and the main line of the T placed vertical. The walls of the tank for all the sizes are made of concrete 8 inches thick and the bottom of concrete 6 inches thick, while the top is roofed with concrete provided with a hinged wooden door at each end, over the inlet and outlet, respectively.

If there should be need for a higher degree of purification of the sewage than the septic tank effects the effluent will be subjected to further treatment.

The sewerage of the city is under the general supervision of the Highways Department, of which August E. Christhilf is the head, with Milton J. Ruark, division engineer of sewers, directly in charge.

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*Assistant designing engineer, Highways Engineer Department, Baltimore.

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Sewerage For Scattered Districts

One of the difficult problems for the sewer department in every growing city is that of providing sewerage for the outlying districts where population is so scattered that a long line of sewer would be needed for reaching each house, and the streets are as yet unopened so that the construction of sewers would be a difficult and expensive matter. A number of cities have adopted as the solution the use of the pail system, but more places require the occupants to solve their own trouble either undirected or under restrictions, such as insisting upon cesspools constructed and maintained according to prescribed regulations.

The city of Baltimore, as described elsewhere in this issue, finds itself faced with a problem of this kind but of unusual magnitude, several square miles of territory being added to the city, some sections of which are provided with small systems of district sewers discharging at points where such discharge cannot be permitted to continue. It has, therefore, decided on a method of district treatment rather than residence treatment, and has adopted for this purpose the use of septic tanks of a standard design which has been prepared by the sewerage engineers of the city. This is considered as a temporary solution only, to be superseded by extensions of the city's sewerage system connecting with the large sewage treatment plant.

This might seem somewhat expensive for a temporary measure, but it will unquestionably be much less so than would be the more common plan of requiring each resident to build his own cesspool, to be abandoned whenever sewers are extended to the property in question.

The question suggests itself whether it would not be possible to use some device for treating the sewage which, when it had played its part at one point could be moved to another which had developed still further from the main lines of the sewer system. Something in the nature of a tank or other device, constructed possibly of steel, even though its first cost might be greater than an ordinary concrete septic tank, would seem to meet such requirement. One of the desirable features of such a tank would be that the entire treatment be inclosed so as to be inoffensive to sight or smell, so that it could be established at any point that would be most convenient and economical in cost of operation. Such a tank might be of the general form of a "Kessel," or air-tight sedimentation tank, or a tank employing the electrolytic process, both of which have been described in this journal.

A number of such plants might be used in those cities (of which there are hundreds in the country) that have not yet extended their sewerage system over more than 50 per cent of even the well-built-up section, these plants being moved outward from time to time as the sewer system is extended to take their place. It does not seem probable that, once established, such a method of treatment would be more expensive than the pail system, and it would seem to be less objectionable to all concerned and more sanitary.

Increasing Society Dues

Many and perhaps most of the various societies of the country, technical and others, have recently been finding their incomes insufficient to meet their annual expenditures. Practically all of them look to the dues paid by their members for by far the largest part of their income, and the only solution of their financial problem appears to be increasing by 50 per cent or more either the dues or the membership. The latter does not seem practicable and the result has been that a great many of the societies have felt it necessary to increase the dues, as was done last week by the American Society for Municipal Improvements.

And yet, a considerable amount of this increase might be avoided, in some societies at least, if all the members would pay their dues. In the society named, the accounts show that from 15 to 30 per cent of the members never pay their dues, being presumably dropped after a few years for non-payment. The writer knows of instances where men have joined the society and been retained as members for three years, receiving the publications and other benefits without ever having paid a single cent towards the society's expenses. If some method could be adopted for insuring the prompt payment of dues, it might be possible, in some cases at least, to avoid the increase of dues or at least greatly reduce it. In clubs it is the practice to post the names of those who are in arrears, and it would seem to be equally in order for a society to make public from time to time the names of those who refuse to respond to the repeated requests of the secretary that they pay their dues or other indebtedness to the society.

Immigration Notes

In Chicago, where there now are more than 700,000 foreigners, citizenship papers are being issued by the Federal authorities to the utmost capacity of their offices. The rush is explained by the chief naturalization examiner as due to three causes, namely, that the petitions for final papers made during the war are now coming due; that Poles, Russians, Germans and Slavs feel they have nothing to gain by returning to Europe; and that American business men are beginning to realize that it is safer to employ American citizens than to employ foreigners who may be radical.

The rapid increase in the arrival of immigrants at New York, which is the chief American receiving port, has entirely overwhelmed the facilities there so that on one occasion it was necessary to detain the aliens for 48 hours on board ship and not allow them to land until the congestion could be somewhat relieved. This rapid increase of volume has already swamped the immigration machinery, and plans are being worked out by the immigration bureau to relieve it by making full use of facilities for handling immigrants at Boston, Baltimore, Norfolk and gulf ports. It is considered possible that an extra session of Congress may be called soon after the November election to deal with immigration problems and although it is not agreed what course will be adopted, it is generally conceded that more care should be exercised by government officials at the port of embarkation to eliminate the undesirable class. As it is, a considerable number of idle and vicious, besides those afflicted with contagious diseases, arrive here and have to be returned, as well as very large numbers that arrive practically destitute and have not funds with which to proceed to the point of their destination.

The proper selection of immigrants by the official inspectors has already succeeded in materially checking the entrance of known radicals. But it is much more difficult to prevent the large increase in the number of immigrants officially classed as "industrial parasites," who, since the war, have been entering this country, not in search of work, but to escape work in their native countries.

A serious difficulty confronting the United States immigration authorities is the proper disposal of alien arrivals who, having heard of the enormous wages now paid in the Eastern states in shops, in factories and in mines, are so determined to share them that 75 per cent refuse to look for employment on farms and in the West, while in the ten years preceding this war the farming districts received more than half of the new arrivals. It is stated by the commissioner general of immigration that neither the Federal nor state laws provide for enforcing a proper distribution of labor.

At the second annual convention of the American Legion in Cleveland, September 29, a vote was taken recommending the abrogation of the existing agreement that limits the amount of Japanese that are now admitted to this country, requesting the exclusion of all Japanese immigrants and opposing the granting of naturalization rights to Japanese already in this country.

In the week ending September 25, 20,503 aliens were examined for admission at Ellis Island, including 16,005 steerage passengers almost exclusively of the immigrant class. Almost all of the second cabin passengers included in the remainder were also in the immigrant class.

On account of the overcrowding of the station, many of the inspections were held aboard ship and on the piers, and the eligibles admitted directly thereafter.

Commissioner Wallis has made temporary provision for decreasing the discomfort in the overcrowded Ellis Island quarters, and has under consideration considerable enlargement of the immigration station there to care for the great rush of immigrants which is considered as yet barely commenced. He states that the ocean ships have booked quarters for a year in advance to full capacity; that new ships are entering the transatlantic business and that one corporation has planned for 20 ships, some of them now under construction. He has been informed that 3,000,000 Italians and even more Germans are anxious to immigrate to this country.

The commissioner stated his determination that our selective immigrant test shall not be made elastic, no matter how great the rush of immigration. He considers it important that the law should be strictly applied and immigrants measure up to American standards and has notified every inspector and doctor not to be disturbed by the extraordinary increase in immigration, but to thoroughly safeguard the country against undesirables, considering that caution should not be sacrificed for policy.

A European Labor Alternative

Two radically different plans for settling the labor situation in Germany are described in recent dispatches from Berlin where a delegation of moderate labor leaders have presented a plan formulated to secure increased production in concert with government action which will make it obligatory for manufacturers to operate their factories continuously, with government guarantee against loss. This will secure government instead of politician control of labor and a special industrial condition will be created consisting of capitalists, technical men and labor representatives, their whole purpose being to conduct industry for the purpose of increased production, not for profit. This scheme has been carefully and thoroughly worked out and is intended to benefit the whole people and reduce taxes.

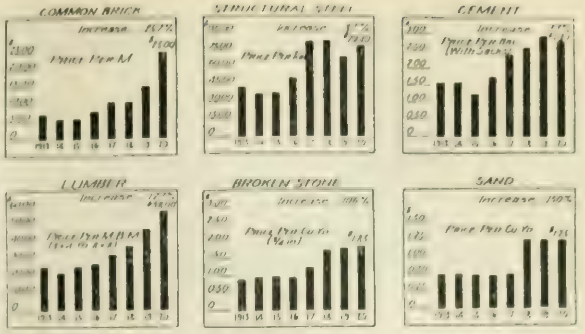
Diametrically opposite to this plan is that proposed by the German industrial leaders, namely, a gigantic trust including practically all manufacturers, that "may suspend production entirely for a while, closing down the whole country in order to get labor into a sensible mood," and thus enable the manufacturers to resume their pre-war profits that were paying them dividends higher than 30 per cent.

Construction Costs to Remain High

Conclusions from a study of the Fuller Industrial Engineering Corporation is that there will be no substantial reduction in building costs for several years to come.

A study of conditions as to building costs made by the Fuller Industrial Engineering Corporation, New York, leads to the conclusion that there is no material reduction of them in sight and that none may be expected for several years. In most respects this subject is as one with engineering construction and contract work, so that the facts and conclusions presented are valuable for consideration and are here summarized.

The report states that a reduction of building costs might be effected by either of three conditions, namely, a reduction in demand, a reduction in wages of labor, or a reduction in price of building materials. As it is estimated that the country is short about $2,500,000 worth of deferred building construction alone, there is no possibility of a reduction in demand until this is made up. In order to make up during the present year the existing shortage in housing alone, it would be necessary to construct an aggregate floor area of 1,597,200,000 square feet, which would be almost as much as has ever been built in any three years. Besides this, there is an annual regular demand for more than 600,000,000 square feet of floors, which should be built in addition to making up this shortage.

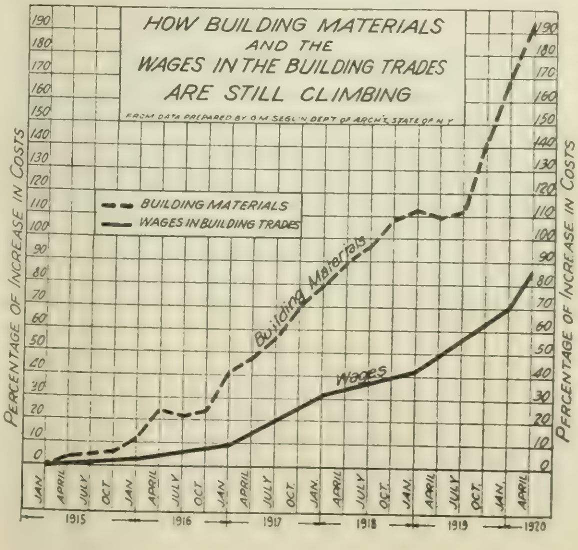


SPRING PRICES OF BUILDING MATERIALS IN NEW YORK FROM 1913 TO 1920

The average cost per square foot of building rose from $1.59 in 1911 to $3.20 in 1919, and the cost of essential crude building materials (even including sand) is from two to five times as great now as in 1913 and 1914. Five out of eight of these materials show an increase in cost over that of 1919, and only one, cement, shows a very slight decrease in cost from 1919, when it had the highest price on record.

The price of all skilled labor has increased, at a very conservative calculation, from a minimum of 56 per cent to 100 per cent, while that of common labor has increased 329 per cent and is still rising, the prices for 1920 being in all cases much higher than in 1919. Skilled labor is dissatisfied and restless and endeavoring to force wages to still higher planes, and as labor costs are 85 to 90 per cent of the cost of building materials, there is little chance of improvement in the matter until labor becomes cheaper or more efficient.

Labor shortage is due to great reduction of immigration since 1914, and the return of foreign workmen to their own countries; to the stimulation of all manufacturing industries by war conditions abroad, and very largely to the development in a wide field in this country of new industries, such as dye manufacturing and shipbuilding. The report therefore concludes: "We know of no other major influence which can bring a marked or immediate reduction in building costs, and our mature judgment is that there will be no substantial reduction for several years to come."



Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

Shallow-Water Cofferdams on Soft Bottom

Wherever any kind of a structure is built in the water, unless it is supported on piles, the construction of the foundation usually requires some provision for temporarily excluding the water from the site until the work has been carried above water level. This is generally accomplished by the use of some type of cofferdam, unless the structure and conditions are of such a character that the foundation can be built in advance and placed as a whole or in sections on the base previously prepared for it, which would ordinarily be a dredged or leveled surface.

Such operations, although often possible, are not generally considered the most satisfactory and economical for small structures, and the cofferdam system in shallow water and on soft bottoms is applicable to great numbers of bridge piers, culverts, sewer outlets, river, lake and harbor work, highway and railway construction and various other ordinary jobs.

It is generally required to carry the foundation through the soft material to solid rock or a hard stratum of earth, sand, gravel or other material having the required bearing power; or to a depth sufficient to be reasonably free from danger of undermining or scour.

For very large structures, unusually exposed situations, very deep or swift water, high tides, or when affected by congested traffic or navigation or other serious difficulties, the work will require competent engineering direction, contractors experienced in this class of work, and special plant or equipment; but for ordinary cases where the depth of the water is less than 6 feet and the excavation required below the bottom is not more than 5 or 10 feet, the work can usually be executed by means of simple cofferdams easily constructed and maintained with materials, labor and equipment generally at hand.

EARTH DAMS

When the bottom is tight enough so that the water will not rise up through it to a great extent inside the cofferdam, and the current is slow and there is no danger from waves, an effective cofferdam may be made with a dam or embankment of common earth 3 or 4 feet thick on top, and with side slopes of 3 on 1, dumped in position from wheelbarrows, trucks, cars or buckets and sometimes taken from the excavation in the cofferdam, which may suffice to build the dam. Dams are made from earth, clay, or clay and gravel mixed, but even sand and gravel will suffice for very low dams, and common earth alone will answer if the dam is thick enough.

An earth dam with a small amount of clay packed in the center from top to bottom is also efficient. If clay is hard to obtain, the amount required may be reduced by depositing it on the inner face of a bank of stone that affords stability without tightness. If any portion of the earth dam is especially exposed to waves or current, it may be protected by broken stone or gravel covering the surface. As the earth dam is likely to be at least six or seven times as wide at the bottom as on the top, considerable space must be allowed for it around the exterior of the finished structure.

If the bottom is of very coarse sand or other material that permits water to rise up through it, it may be necessary to shut off the water below the bed of the stream. This can frequently be done efficiently by driving planks or any other convenient form of sheet piling on the center line of the dam down to rock, or a hard or tight stratum which often occurs a few feet below the surface. Planks closely driven need not be absolutely water tight either above or below the bottom because the mud and sand carried through the leaks have a tendency to close the joints and the upper part of the piles will be embedded in the impervious material of the dam.

FILLED COFFERDAMS

If material suitable for an earth dam is scarce or if there is not space available for the wide base of an earth dam, two parallel lines of sheeting can be driven 3 feet or more apart and the space between them filled with rammed earth or clay. Often it is desirable to fill earth also against the outer face of the cofferdam, which will help materially to close any leak through or under the dam.

When sheet piles are used, they should be carefully aligned against outside rangers at the top, and the two lines should be separated by horizontal transverse braces and through-bolts adjacent to them tightly screwed up.

SHEET PILE COFFERDAMS

Where the bottom is very soft and loose and water flows freely through it, it may be necessary to construct a complete sheet-pile cofferdam which is itself as nearly water tight as possible. Where the piles have to be driven to a considerable depth, or where the driving is hard on account of compact sand, gravel or obstructions like boulders, logs, etc., interlocking steel sheet piles should be used. In other cases tongue and groove or splined planks not less than 2 or 3 inches thick may suffice for moderate lengths.

Wooden sheet piles should be beveled at the lower ends so as to draw close against the pile last driven and should be driven between pairs of ranger timbers firmly held in position. To get the best results the rangers should be bolted together at frequent intervals with removable fillers and each pile as driven should be tightly wedged against the filler to maintain it closely in contact with the pile last driven and insure the proper engagement of the tongue and groove or splined joint. The rangers should be left in position and braced across the cofferdam or with inclined struts to the bottom, to resist pressure from the outside.

In very soft material the piles may be driven by hand with heavy mauls, but it is much more satisfactory and advantageous to drive them with a light drop hammer operated by power, or still better with a steam hammer actuated by steam or compressed air. A hammer improvised from a rock drill is often efficient for this purpose.

Wherever water pressure of 100 pounds or more is available, it affords the best method of driving piles in many hard, compact materials, being used as a hydraulic jet attached to the foot of the pile or sometimes operated in advance. It is especially valuable in hard sand, in fine gravel or for undermining and displacing small boulders and often enables the piles to be driven with great rapidity.

For small sheet-pile cofferdams a complete set of rangers should be set up and all of the piles assembled against them around the circumference of the cofferdam and driven simultaneously, the hammer going round and round and driving each pile a short distance and then the next and so on, in successive trips until all are driven.

If for any reason this is not practicable, there is likely to be difficulty in driving the closing pile. Sometimes this cannot be driven and the piles are driven to overlap each other or a short section of piles is driven across the gap between the first and last piles.

If subterranean obstacles like boulders or logs are encountered by the piles, too deep to be dug out, piles should be driven close to both sides of the obstacle and when the cofferdam is unwatered excavation can be carried down these to permit the removal of the obstacle and the completion of the pile driving at that point.

After the cofferdam has been completed and unwatering is commenced, if serious leaks develop through the sheet piles, they may often be stopped by dumping earth, clay or other suitable material on the exterior of the cofferdam. Sometimes excavations can be advantageously made there and then filled with the new material. Ordinary small leaks can be generally closed up by mud, sand, earth, sawdust or manure dumped so as to be drawn into the cracks.

In very shallow water with mud bottom, cofferdams may consist of wooden panels of convenient size, wide enough for the whole height of the cofferdam walls, and as long as can be handled. Piles or cribs are located at panel lengths around the cofferdam line and these panels are set in place bearing against them and butting joints over them with their lower edges forced down as deep as possible in the bottom. These have the advantage of having tight joints except at the bearing, where they may be covered, and in good bottom may serve very well for shallow water.

For cofferdams of moderate dimensions, say up to ten or fifteen feet wide, bottomless tight wooden boxes may be built complete on shore and set in position by derricks or floated out and sunk. After being put in position they may be covered with a loading platform and quantities of stone, sand or other ballast may be placed on them to force them down as far as possible into the soft bottom, a process which may be continued after the interior excavation has been commenced.

RIVETED STEEL COFFERDAMS

Under some conditions, especially when many cofferdams of the same size can be used successively, cylindrical cofferdams made of thin steel plates riveted, may be used advantageously. These are light, absolutely water tight, easily handled, and can be used many times and salvaged after the completion of the job. They do not require interior bracing and in some cases may be arranged to provide part of the finished structure and be paid for as such. Such cofferdams can be up to 10 or 12 feet in diameter, and like the wooden panels can be made to penetrate below the surface of the ground by loading and by interior excavation, or by the use of a water jet around the edges. They should not, of course, be sunk any deeper than is necessary to secure a satisfactory seal, on account of the difficulty of removing them, which, however, may be facilitated by use of the water jet or by dredging around them if necessary.

Where a very deep excavation is required inside a small cofferdam, the use of steel cylinders may be almost inevitable in order to exclude the water and prevent the sides from caving in. It may also be necessary if the bottom is so bad so that water rises freely through it inside the cofferdam, in which case steel cofferdams can easily be dredged by buckets or scoops working under water and be driven down by loading as the excavation progresses. But if they are sunk to any great depth it will be impossible to remove them and they must be estimated as part of the construction cost.

SECTIONAL COFFERDAMS

If the cofferdam is very large or if the water enters freely through the bottom, it is usually advantageous to build it in several successive closed sections or at least to separate it by interior cross-walls, thus providing small areas which can be unwatered and excavated separately and foundation units built in them piecemeal and finally joined to make the completed structure. Often a specially bad portion of quick-sand or a spring is encountered that can be handled in this way and the whole cofferdam be kept dry at one time. If particularly troublesome leaks or springs occur in the interior of a cofferdam, they can be enclosed by a small cofferdam or a steel cylinder sunk by the above-mentioned process, thus permitting the remainder of the cofferdam to be unwatered and excavated much more readily. Similarly, if very much trouble is encountered by leaks in the outer wall of the cofferdam, these portions can be enclosed by small cofferdams and either filled with puddled clay or excavated and the leaks stopped.

Sometimes when the bottom is so bad that it is impossible to prevent the water from rising through it and it becomes very difficult to unwater the cofferdam even in small sections, it is permissible to excavate to the required depth by drag-line, orange peel, clamshell or other buckets and then deposit a layer of concrete under water over the bottom. When this concrete has set it will form a seal and stop the bottom flow to a large extent. The cofferdam can be unwatered with moderate pumping and the remainder of the foundation built in the dry. In such cases it is, of course, necessary to carefully calculate the maximum upward pressure of the water under the concrete slab and make the slab thick enough and strong enough to resist it, assisted, if necessary, by ballast or bracing on top of the slab.

Concrete Arch Bridge Erected by Drop Cableway

The Springfield pike is carried across the tracks of the Big Four and of the Erie Railway near the Huffman dam in the Miami Valley by a reinforced concrete bridge by the Miami Conservancy District and described in the August number of the Conservancy Bulletin.

The bridge of the half-through, three-hinge, arch type has two ribs of 126 feet span and 21 feet rise with cast steel hinge bearings and 2¾ inch bronze pins 28 inches long. The 18-foot roadway has a girder beam, and slab floor 9 inches thick with transverse expansion joints, which is suspended from the crown of the arch and carried on columns at the ends.

The bridge was built on ordinary trestle falsework about 50 feet high with a wide center opening, spanned by heavy I-beams to provide clearance for traffic on the railroad track below.

The falsework was erected and the concrete for the structure was handled by a drop cableway of about 250 feet span located on the axis of the bridge. One end of the cableway was carried over a tower and anchored in the usual manner beyond the end of the bridge. The other end of the cableway was supported at the top of a 45-foot mast or gin-pole and thence continued to one drum of a well-anchored steam hoisting engine. The bucket was operated by a line on the other drum of the hoisting engine which hauled it up towards the top of the mast, empty, and when full, realeased it and allowed it to descend by gravity. To lower the bucket, the cableway line on the engine druum was slacked off. The trolley hoist used for erecting the falsework was operated in the same way as the concrete bucket.

Concrete was mixed in a ½-yard Smith machine located at the end of the bridge opposite the hoisting engine and was transported to the forms in a 1-yard bottom-dump bucket.

As the concrete was placed in December and January last, special provisions were necessary to prevent injury from frost. Mixing water was heated in an extra upright boiler and sand and gravel were thawed and kept warm by fires burning in sections of old 15-inch dredge pipes over which the aggregate was piled. The top of the structure was covered with tarpaulins under which salamanders were operated until the concrete had set.

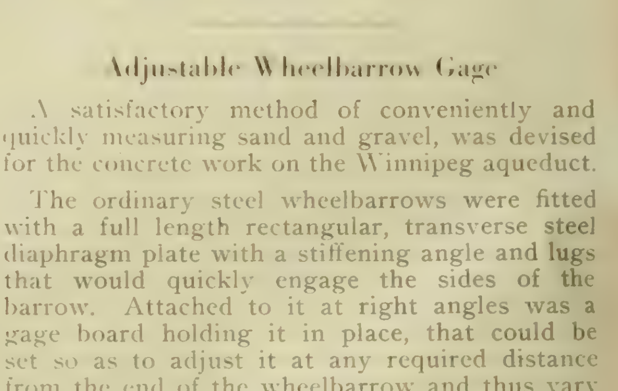
The bridge was designed and built by the Miami Conservancy District, Arthur E. Morgan, chief engineer, Chas. H. Paul, assistant engineer, R. M. Riegal, designing engineer, and Leslie Wiley, superintendent of construction.

Adjustable Wheelbarrow Gage

A satisfactory method of conveniently and quickly measuring sand and gravel, was devised for the concrete work on the Winnipeg aqueduct.

The ordinary steel wheelbarrows were fitted with a full length rectangular, transverse steel diaphragm plate with a stiffening angle and lugs that would quickly engage the sides of the barrow. Attached to it at right angles was a gage board holding it in place, that could be set so as to adjust it at any required distance from the end of the wheelbarrow and thus vary the space inclosed by it and the three sides of the barrow.

When the material was struck off with a straight edge, a definite quantity was thus accurately determined which could be used for measuring concrete and easily changed to suit varying requirements.



BARROW USED FOR MEASSURING AGGREGATE

Recent Legal Decisions

SURETY NOT RELEASED BY PAVING CONTRACT WITH TRACTION COMPANY

In the materialman's action on a bond to recover the price of brick supplied a contractor for a street improvement, it appeared that the city and a traction company made an agreement whereby the contractor should also pave the trackway. The Supreme Court of South Carolina holds, Mack Mfg. Co. v. Massachusetts Bonding & Ins. Co., 103 S. E. 499, that the bonding company assented to this agreement by executing a bond to save the traction company harmless, and could not, in a suit on the street paving bond, claim that it was prejudiced by this contract with the traction company so as to release it from liability under the bond.

FAILURE TO NOTIFY OWNER OF STREET PAVING IMPROVEMENT VOIDS ASSESSMENT.

The Mississippi Supreme Court holds, City of Jackson v. Mims, 85 So. 124, that, under sections 3411 and 3412, Miss. Code, 1906, failure to serve the abutting property owner with notice of special improvements, such as street paving, and that the cost thereof will be assessed against the owner, renders any assessment against such owner void, and justifies the interposition of a court of equity.

PAVING CONTRACT HELD TO CONFORM SUBSTANTIALLY TO CITY'S RESOLUTION

A resolution of necessity under the Iowa Code, which requires that the resolution state "the one or more kinds of material proposed to be used and the method of construction," recited that a "cement concrete pavement seven inches in thickness, was to be laid. The city council advertised for bids for a pavement "six or seven inches in thickness," and the contract was let to the lowest bidder for a pavement six inches thick. Suit was brought to enjoin performance of the contract on the ground that the city was without authority to enter into a contract for the construction of six-inch concrete pavement instead of seven-inch pavement. The Iowa Supreme Court holds, Richardson v. City of Denison, 178 N. W. 532, that the resolution constituted the sole authority of the officers of the city to take bids and enter into the contract. The improvement must be the one the resolution calls for and not something different. The court said: "It is well known that the depth of concrete required for durability depends largely upon climatic condition, the kind of soil, the extent and character of the traffic, and the like, and in the absence of any showing we are not able to say that six-inch pavement will not serve the purposes of this improvement as well as though it were seven inches in thickness. If it will prove as durable and efficient in use as would a seven-inch pavement, we are inclined to the opinion that the little reduction in thickness of one inch, or one-seventh, would not be a material departure from the method of construction prescribed in the resolution. Such a resolution need not describe the material or materials of construction with technical nicety. All that is essential is that it state these in a general way, leaving the details to be wrought out in the plans and specifications." In the absence of evidence indicating that the reduction of one inch would materially affect its durability or its adaptability for the purpose proposed, it could not be said that there was a material departure by such reduction from the requirements of the resolution of necessity.

POWER TO ERECT VILLAGE HALLS WITHOUT EXPRESS STATUTORY AUTHORITY

The Minnesota Supreme Court holds, Powers v. Village of Chisholm, 178 N. W. 607, that a village, though without express statutory authority to do so, has power to construct a village hall for the transaction of public business. Village halls have been erected throughout Minnesota from early times without serious question of authority in the village. The village must transact public business. The power to provide a place in which it may be transacted is essential to the existence of the village. The authority to erect a village hall is incidental to the maintenance of village government.

SUFFICIENT AND INSUFFICIENT CLAIMS FOR CONSEQUENTIAL DAMAGES FOR DELAY

Where a contractor claimed consequential damages arising from delay in the work, alleged to have been the fault of the owner, a statement of claim as to the increased cost of lumber used for concrete forms was held by the Pennsylvania Supreme Court, Cramp & Co. v. Central Realty Corp., 110 Atl. 763, to be sufficient, it being alleged that the amount paid was the fair and reasonable market price; but a statement of claim as to the amount paid for extra hauling, loading and unloading steel was insufficient as was an item representing the amount paid for having delivery postponed of rods to be used in concrete, there being no statement of the place from which the hauling was made, the number of laborers engaged, the time of their employment, or the wages paid them, and no other data from which it could be ascertained whether the price was in fact a reasonable one.

BOROUGH HELD NOT LIABLE FOR TOWNSHIP HIGHWAY EXPENSE

The Pennsylvania Supreme Court holds, Plymouth Tp. v. Borough of Larksville, 119 Atl. 801, that under the statute of June 12, 1878, providing that every borough which has been or which shall be erected out of any townships shall share in just proportion the rights and liabilities of said township or townships existing at the time of its incorporation, a borough which has been formed out of a township soon after the execution of a contract by the township to pay part of certain highway improvements, but before such payments are due, cannot be held liable for a share thereof, the debt not being an existing one.

NEWS OF THE SOCIETIES

Nov. 5-6—IOWA SECTION, AMERICAN WATERWORKS ASSOCIATION, Sixth Annual Convention, Iowa City, Iowa. Jack J. Hinman, Secretary-Treasurer State University of Iowa, Iowa City.

Nov. 8-12—LEAGUE OF CALIFORNIA MUNICIPALITIES. Annua lConvention, Chico, Calif. W. J. Locke, Pacific Bldg., San Francisco, Calif.

November 12—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Second Fall meeting, Chicago. Sec., 33 W. 39th St., New York.

Nov. 12—CONFERENCE ON EMPLOYMENT AND EDUCATION, sponsored by the American Assn. of Engineers. Chicago.

Nov. 15-17—CITY MANAGERS, ASSOCIATION. Annual convention at Cincinnati, O. Executive Secretary, Harrison G. Otis, 812 Tribune Bldg., New York City.

Nov. 18-19—AMERICAN ENGINEERING COUNCIL. Organization meeting. Washington, D. C.

Dec. 7-10—AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual meeting, New York. Secretary, 29 W. 39th St., New York City.

Jan. 25-27, 1921—THE AMERICAN WOOD PRESERVERS ASSOCIATION. Place of meeting to be announced later.

May 17-19, 1921—NATIONAL FIREMEN'S ASSOCIATION. Twenty-third annual convention. Fort Wayne, Ind.

June 7-9, 1921—NATIONAL FIRE PROTECTION ASSOCIATION. Annual meeting. San Francisco, Cal.

June, 1921 — CONFERENCE OF MAYORS AND OTHER CITY OFFICIALS, State of N. Y. 12th Annual Conference. Elmira, N. Y.

AMERICAN ASSOCIATION OF ENGINEERS

With a large attendance assured, the conference on employment and education sponsored by the American Association of Engineers, which will be held in the Congress Hotel in Chicago on November 12, promises to be an inspiring meeting. All free employment bureaus and agencies are being invited, as well as representatives from engineering societies and engineering colleges.

The purpose of the meeting is to consider the general problems of employment.

The following subjects are not all that will be considered at the conference, but are merely those which have been determined upon definitely. Additional speakers and subjects will be announced later.

George P. Hambrecht, chairman of the Industrial Commission of Wisconsin, will speak on Employment Office Administration and Technique.

A. B. Crawford, director of the bureau of appointments of Yale University, will deliver an address on Placing the Graduate in His First Position.

A. B. McDaniel, development specialist in construction for the War Department at Camp Dix, will speak on Educational Work for the Permanent Army.

Professor Arthur F. Payne, chairman of the trade and industrial department of the college of education in the University of Minnesota, has selected as his subject Vocational Analysis and the Engineer.

James P. Munroe, vice-chairman of the Federal Board for Vocational Education in Washington, will discuss Vocational Advisement as a Prime Function of Educational Institutions.

R. O. Kramer, manager of the mechanical department of Montgomery, Ward & Co. of Chicago, will speak on Engineering Opportunities in Large Mercantile and Mail Order Houses.

A. A. Potter, dean of engineering in Purdue University, will speak on Summer Employment for Men in Teaching Service.

The session will begin at 9 a. m. and after several subjects have been discussed will divide into four group meetings at about 11 a. m. Those attending will be divided into four groups, according to present plans, (1) employers and employment manager, (2) managers or representatives of free employment bureaus, (3) representativs of educational institutions, and (4) those not in any of the other three groups.

The national Executive Committee of the American Association of Engineers has approved the proposed bill for licensing engineers, architects and surveyors in Ohio, as presented by Cecil L. Rood, president of the Ohio Engineering Society and the Ohio Association of Technical Societies, and approved by the Ohio Assembly of A. A. E.

HIGHWAY TRANSPORT CONFERENCE

At a transportation conference held September 27 and 28 at Akron, Ohio, in response to a call by the Federal Highway Council, committees were appointed to lay out and direct a movement to co-ordinate all existing transportation agencies. Highway officials from practically every section of the country were in attendance. The motor industry was well represented, and for the first time in history railways—steam and electric—waterways and express companies took part in a good roads meeting.

One of the serious phases of road development, that of sub-grade and its relation to the road surface, came before the conference, under the leadership of C. M. Upham, state highway engineer of Delaware, and vice-chairman under General Coleman DuPont, chairman of the sub-grade committee of the Federal Highway Council. The committee will seek to determine definitely how sub-soils shall be treated in order to prevent damage to the costly road surface. In the hope of accomplishing this purpose, field tests will be made to determine the bearing power of various kinds of soil, studies will be conducted in drainage, and a study will also be made to ascertain by what chemical method the bearing value of the soil may be increased. The definite and express purpose is to open the way for the construction of roads that will meet not only present, but future traffic on the highway and permit the motor truck to assume its inevitable position as a real factor in transportation.

The relation of the highways to railroads, waterways and other forms of transportation to the end that such carrier agencies may be properly co-ordinated in public service is in charge of a committee headed by W. J. L. Banham, of New York, member of the executive committee of the National Industrial Traffic League. F. S. Holbrook, vice-president of the American Railway Express, pledged the co-operation of the interests which he represented, in the movement, to add the public highway to the nation's transportation system.

The Federal government was represented by Dr. R. S. MacElwee, director of Foreign and Domestic Commerce, Washington, D. C., and Major J. M. Ritchie, motor transport division, transportation service, Quartermaster's Corps, Washington, D. C. An educational committee under the chairmanship of W. E. Blodgett, of Philadelphia, was formed to co-operate with the Educational Bureau in furthering the efforts of the Council in practical and intelligent highway development.

Meetings of a similar character will be held at other centers where the production of highway rolling stock is a leading industry.

ENGINEERING INSTITUTE OF CANADA

A convention was held at Niagara Falls, September 16 to 18, and thorough inspection was made of the nearby Queenston-Chippawa power canal of the Ontario Hydro-Electric Power Commission and of the reconstruction of the Welland Canal by the Canadian government.

Among papers and addresses presented were an illustrated talk entitled "The St. Lawrence Route and the Welland Ship Canal," by Alexander J. Grant, engineer in charge, Welland Ship Canal. Papers by members of the staff of the Hydro-Electric Power Commission of Ontario, describing the new 500,000 h. p. hydro-electric development at the Falls were as follows: "Design of the Queenston-Chippawa Power Canal," by T. H. Hogg, assistant hydraulic engineer; "Hydraulic Installation of the Queenston-Chippawa Power Development," by M. V. Sauer, hydraulic engineer of design; "Electrical Features of the Queenston-Chippawa Power Development," by E. T. J. Brandon, electrical engineer, and a final summarizing paper by H. G. Acres, hydraulic engineer, entitled "General and Economic Features of the Queenston-Chippawa Power Development."

An interesting demonstration was given by N. R. Gibson of the Niagara Falls Power Company of his new method of measuring the flow of water in closed conduits for determining the efficiency of hydraulic turbines.

The convention was entertained at luncheons by the Department of Highways of the Province of Ontario and by the Park Commission. There was also a dinner and banquet. The convention was one of a series held in different Provinces of the Dominion and was under charge of the Niagara Peninsula branch of the Institute. It was attended by more than two hundred members and guests, including many ladies. The next one will be held in October in Halifax.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA

At the regular Pittsburgh meeting, September 21, a paper on small turbines, illustrated by lantern slides, was presented by W. J. A. London, president of the Steam Motors Company.

THE ENGINEERS' SOCIETY OF WESTERN MASSACHUSETTS

The fall meeting was held September 21, at the General Electric Company Works, Pittsfield, Mass., which were inspected with particular attention to motor construction. "Motor Application" and the principal characteristics of various kinds of motors were discussed by experts.

DETROIT ENGINEERING SOCIETY

The Detroit Engineering Society announces the following program: Nov. 5, "Conditions in Europe from a Political, Social and Engineering Standpoint," by E. J. Mehren, editor of *Engineering News-Record*; Nov. 19, "New Water Filtration Plant for Detroit," by Major T. A. Leisen, engineer for the Board of Water Commissioners.

The Alaska Road Commission has been re-organized with Major James G. Steese, Corps of Engineers, president; Captain John C. Gotwalls, Corps of Engineers, and Captain C. W. Ward, Corps of Engineers, secretary and disbursing officers. Headquarters will be at Juneau with offices also at Valdez, Seward, Fairbanks and Nome. The commission has charge of the maintenance of nearly 5,000 miles of roads and trails, which are being extended as fast as funds permit.

PERSONALS

Hart, L. H., has been appointed manager of the construction department of the National Lime Association, Washington, D. C.

Holmes, Major E., has been appointed manager of the chemistry department of the National Lime Association, Washington, D. C.

Bruce, John A., city engineer of Omaha, Neb., has resigned to return to private business.

Darcy, Henry J., has been appointed state sanitary engineer of Oklahoma.

Judd, W. A., general superintendent of the municipal water works and electric light plant of Dover, Ohio, has resigned to return to private business.

Spear, R. E., has been appointed borough engineer of Ambridge, Pa.

Bachmann, Frank, formerly chief chemist, Connecticut State Department of Health, has resigned to join the staff of the Sanitary Engineering Department of the Dorr Company.

Holmgreen, E. L., has been appointed to the engineering staff of the Manitoba Power Commission, Winnipeg.

Allan, E. B., has been appointed assistant road engineer, Hamilton, Ont.

Longino, J. L., has been made manager of the Pine Bluff Co., Pine Bluff, Ark., operators of street railway, electric light and water properties.

Mitchell, McClain, superintendent of public improvements of Paducah, Ky., has been appointed city engineer.

Arnold, Ralph R., county engineer of Contra Costa county, California, has been appointed county highway engineer.

Watkins, Vaughn, has been appointed state highway commissioner of Mississippi.

Bennett, M. O., formerly engineer of the Oregon State Highway Department, will start farming on a large scale in Lewistown, Mont.

Hepburn, Donald M., has resigned as chief of construction of the Pennsylvania State Highway Department.

Sauerbun, Alfred H., has been named to succeed Mr. Hepburn.

Sacket, W. H., formerly with the engineering staff of the Wisconsin State Highway Commission, is now connected with the Forest Products Laboratory.

Couzens, Henry Herbert, chief engineer of the Toronto Hydro-Electric System, has been granted an indefinite leave of absence, during which time he will act as manager of the new Transportation Commission of the city of Toronto. When the commission is fully organized he will resume his duties as chief engineer, directing the work of the commission also.

Ashworth, Edw. M., has been appointed general manager of the Toronto Hydro-Electric System during the leave of absence of Mr. Couzens.

Gillespie, Peter, for the past nine years associate professor in the Department of Applied Mechanics, Faculty of Applied Science and Engineering, University of Toronto, has been given the rank of professor.

Snaith, Wm., formerly principal assistant engineer with Frank Barber and R. O. Wynne-Roberts, has resigned to accept an appointment as chief draftsman of the Riordon Co., Ltd., Mattawa, Ont.

Blanchard, Arthur H., Professor of Highway Engineering and Highway Transportation at the University of Michigan, has been appointed Consulting Engineer to the Michigan State Highway Department.

Bruce & Grupe, engineers, 312 Karbach Bldg., have changed their address to Room 404, Finance Bldg., Omaha, Neb.

Coulson, R. H., has been appointed district engineer of the western district, New York Central Lines.

Crissey, Jackson R., formerly city engineer of Johnstown, Pa., will enter the construction field.

Druar & Milinowski, recently organized, will have their offices at 512-14 Globe Bldg., St. Paul, Minn. They will continue with the work of Mr. Druar, consisting mainly of municipal engineering and hydro-electric developments.

Henderson, Charles E., manager of the Windsor, Ont., branch of Morris Knowles, Ltd., has been appointed division engineer of their Detroit office.

Keith, J. Clark, of Morris Knowles, Ltd., Windsor, Ont., has been appointed assistant chief engineer of the Essex Border Utilities Commission, having jurisdiction over the water supply, sewerage and park systems of the seven municipalities bordering on the Detroit river.

Norcross, T. W., has been appointed chief engineer of the Forest Service, U. S. Department of Agriculture.

Patzig, Monroe L., consulting engineer, Des Moines, has been appointed plant inspector for asphaltic paving materials now being used in Rock Island, Ill.

Routh, James W., director and chief engineer of the Rochester Bureau of Municipal Research, has opened offices at 501 Arlington Bldg., Rochester, N. Y., where he will be available as a consulting municipal engineer.

Shaughnessy, C. S., formerly engineering examiner in the New York City Civil Service Commission, has been appointed chief examiner of the Civil Service Commission of Philadelphia.

Shaw, Arthur M., consulting engineer, New Orleans, La., will have general direction of the civil engineering department of Loyola University, retaining his office for private practice.

Stephenson, E. J., of Minneapolis, has been appointed civil engineer for the United Light & Railway Co., Davenport, Ia.

Washington, W. O., formerly engineer of Caldwell County, Tex., has been appointed highway engineer for Cameron county, with headquarters at Brownsville, Tex.

Raines, Hugh B., died in Louisville, Ky., September 17. Mr. Raines was for twenty years city engineer of Dallas, Texas, retiring several years ago.

Bussler, William C., chief engineer of water works, Waterloo, Iowa, died in that city on September 12.

Dietrich, William Henry, resident engineer of the U. S. Steel Products Co., in Bombay, India, died in that city August 11.

Cooley, George W., state engineer and secretary of the Minnesota Highway Commission, died in Minneapolis, September 25.

Isaacs, John J., Jr., chief engineer, S. J. Junkins & Co., Ltd., was accidentally killed October 1.

Sherman, James H., president Sherman Engineering Co., Kansas City, Mo., died on October 2.

JAMES W. ROUTH, C.E.

James W. Routh, C. E., Director and Chief Engineer, Rochester Bureau of Municipal Research, Inc., announces that he is available for service as consulting municipal engineer and is prepared to conduct investigations, prepare plans, specifications and reports, and supervise operations in connection with all municipal engineering activities.

Special service can be rendered municipalities interested in improving the organizations and administrative procedure of their departments of government. Offices, 501 Arlington Bldg., Rochester, N. Y.

STEVENS & KOON

J. C. Stevens and R. E. Koon announce their new consolidation under the firm name Stevens & Koon, consulting engineers. Particular attention will be given to matters pertaining to municipal improvements, water supply, sewerage, irrigation, hydro-electric power, appraisals and valuation. Offices, Spalding Bldg., Portland, Ore.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

LIDGERWOOD STEAM HOISTS

Steam hoisting engines for contractors' uses are described in Bulletin 2, issued by the Lidgerwood Manufacturing Company. A large variety of standard machines include types designed for bridge and building erection, building elevators, derricks, pile-drivers, dredges, drag buckets, inclines, quarries, prospectors' use, shafts, etc., together with a considerable amount of auxiliary equipment, such as boilers, boom swinging engines, drum frictions, swinging drums and swinging gears. Of each type there are given the principal data, including the weight hoisted on a single rope at given speed for the rated horse-power, together with the principal dimensions.

All of the standard hoists are built on the duplicate part system, which makes the parts interchangeable and allows the manufacturers to keep in stock a full line of finished parts to fill repair orders instantly. All engines are set up and run under steam before shipping.

The drums are accurately balanced to prevent undue wear of the bearings and the brakes are usually of the band type lined with hard-wood blocks and provided with adjustment for taking up wear.

In ordering hoists, the purchasers should state the maximum load, speed and height, whether the load is to be hoisted on a single line or with a tackle, the diameter of rope used, the frequency of hoisting, and, if light loads are to be hoisted and heavy loads lowered, specify the load to be lowered, how far and at what speed.

ECONOMY EXCAVATOR

The "Economy Excavator" is primarily intended for jobs involving from 10,000 to 20,000 yards of open ditch work as well as for cleaning bottoms of large open ditches. It is also largely used for constructing large tile drains and sewers. The low operating cost and upkeep and large capacity recommend it for a large amount of work in ditches, trenches, banks, road construction, wagon and car loading, irrigation work and the like for which it has attained a high degree of efficiency.

In open work the long boom enables it to dig a much wider ditch than can be done with the average small excavator, and it will dig to any required slope and leave the sides smooth. In such work the machines excavate as much as 125 cubic yards per hour and often 500 yards per shift.

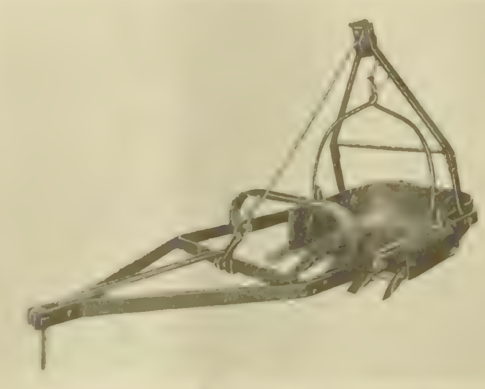
The machine can be erected by four men in an average time of three days and is operated by only two men, one to handle the levers and one to do general work around the machine.

A special type of machine with booms [illegible] 40 feet wide, is recommended for ditch cleaning and repairing, and for the enlargement of irrigation ditches. For laying lines of large tiles, four men are sufficient. Tiles up to 42 inches in diameter can be handled with the standard bucket and up to 28 inches with a narrower trench digging dipper.

In back-filling the bucket is never hoisted and often moves 1 to 1½ yards of material at each operation, five to seven of which can be made per minute.

One contractor writes that he has loaded 500 yards of material into wagons in one shift.

The machine is equipped with a 40-horse-power gasoline and kerosene engine. It has a very heavy, durable steel frame and the wheels have tires 36 inches wide. The trussed boom is in two parts. The 5-yard capacity digging dipper will work equally well in dry material or under water, and when the fill line is slacked it dumps immediately. All the working parts are driven with friction clutches, which are of the same size, so that the blocks and fingers are interchangeable.



BUCKET IN EXCAVATING POSITION

MANHOLE COVERS

The D. & D. Safety and Noiseless Manhole or Catch Basin Cover is apparently meeting a real want. The city of Minneapolis used six in 1916 as an experiment. The next year twelve were bought, in 1918 fifty, in 1919 601 and in 1920 that city will use about 600. The covers seem to be giving satisfaction wherever used. The city engineers of Cincinnati and Oak Park, Ill., where the covers are in use, say that they do not rattle or become loose.

It is claimed that these covers can be sold at about the cost of the ordinary covers and that they have a longer life. The Wm. E. Dee Company is the manufacturer.

NEW TRUCK CATALOG

The Parker Motor Truck Company announces that its new catalog is ready for distribution. It is unique in that it is confined almost exclusively to truck features, all sales talk having been omitted. Recent changes in models are incorporated.

THE LA FRANCE FIRE ENGINE CO., INC.

During the month of September there were reported from this company 24 sales of fire engines and trucks, ten of which were repeat orders. The shipment for the same period totaled 44 engines, cars and trucks, besides 3 Brockways which were distributed throughout 22 different states.

INDUSTRIAL NOTES

NATIONAL LIME ASSOCIATION

Further extensions of the organization of the National Lime Association for educational publicity work have recently been made. This is in the direction of intensifying the local or district work. The latest extension of the organization consists of the establishment of a central bureau in the Mississippi Valley, comprising Districts 7 and 12 of the association which include the states of Indiana, Illinois, Missouri, Nebraska, Colorado, Kansas, Oklahoma, Arkansas and Louisiana. The officers of this central bureau are Col. C. W. S. Cobb of the Glencoe Lime & Cement Co. of St. Louis chairman, and T. P. Black of the Black White Lime Co. of Quincy, Ill., secretary. They will employ a permanent field man, who is a trained engineer along construction lines and qualified to deal with the chemical and agricultural uses of lime, to traverse the territory and assist in the best use of lime products in the three aspects in which it is employed, namely, in construction, in various chemical industries, and in agriculture.

Committee C-7 of the American Society for Testing Materials, which has in its charge all matters relating to lime, met on October 4 and 5 in the rooms of the Society in Philadelphia. The committee comprised representatives of the leading manufacturers of lime, engineering schools of well-known universities, American Institute of Architects, State Highway Departments, engineering firms, the Bureau of Standards, the Bureau of Soils, Department of Agriculture, Geological Survey, the Plasterers' Union, Agricultural Experiment Stations and manufacturers who use lime reactions in their processes. The personnel of the general committee appears on the attached sheet.

Important developments along the lines of plasticity, chemical analysis, effects on concrete and specifications for various uses, secured a large attendance.

PUBLIC WORKS.

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 49 FLORAL PARK, OCTOBER 30, 1920 No. 18

Fitchburg Sewage Treatment Plant

This plant is six years old and during that time has been operated under careful, expert supervision and excellently full records kept. It is therefore one of the important ones of the country to the sewerage engineer and chemist-biologist. During all of last year the sprinkling filter was run at about double rate in order to learn how long it would serve without extension. Deposits of grit from combined sewers in the Imhoff tanks are believed to have caused foaming, and were removed, but with difficulty. The tanks averaged 98 per cent removal of settleable solids higher than previously because of skimming and keeping slopes and slots clean. The general efficiency of the plant was good; the final effluent was always non-putrescible by the methylene blue test. Considerable attention was paid to the appearance of the grounds, trees and shrubs planted, roads surfaced, etc. The total cost of operating the plant was $9.56 per million gallons, or 30.3 cents per capita served, not including the cost of pumping part of the sewage or the overhead charges.

The sewage treatment plant at Fitchburg, Mass., is one of the most interesting in the country, chiefly because of the careful and scientific operation which it receives and the pains which are taken to detect and eliminate any features of the operation which tend to limit the efficiency that it is possible to obtain from it. The plant was described quite fully in Municipal Journal for September 17, 1914, but it seems desirable to briefly restate the principal features of the plant as a preliminary to a report on last year's operation.

In both the preliminary studies and the preparation of the final plans for this plant, David A. Hartwell, who is commissioner of public works and city engineer of Fitchburg, was in charge, with Harrison P. Eddy as consulting engineer.

The plant consists of five rectangular Imhoff tanks, two acres of sprinkling filters, four circular secondary settling tanks, and about four-tenths of an acre of sludge drying beds. The sludge beds lie slightly higher than the sludge compartments of the Imhoff tanks, and sludge from the latter is lifted by compressed air onto the beds. In reaching the plant the sewage passes through a 30-inch siphon about a mile long, between which siphon and the tanks is a 30 x 15-inch venturi meter.

Each tank is 31 feet wide by 90 feet long and contains three hopper bottoms which are 7 feet 6 inches deep; the total depth of the tank being 25 feet 11 inches, or 24 feet 5 inches to the top of the sewage in the sedimentation compartments. The sludge compartments were calculated for a capacity of six months' sludge accumulation.

The filters are 223 feet by 405 feet and the broken stone is 10 feet deep to the bottom drainage system.

The secondary tanks are 30 feet inside diameter with vertical side walls 14 feet 9 inches high and conical bottoms having a depth of 9 feet 3 inches; giving a depth of liquid in the tanks of 22 feet 9 inches. The filter effluent enters each tank through a vertical pipe in its center with the outlet near the bottom and leaves the tank through weirs around its circumference. The tanks are designed for a retention period of one hour. The deposits in the secondary tanks are pumped back into the Imhoff tanks to be digested with the crude sludge settling in such tanks.

The cost of the plant was about $309,000, including $25,000 for the land. Four per cent interest and six per cent sinking fund on this cost would give an annual charge of about $31,000. The plant was first put in operation in October, 1914, but all the parts of the plant were not in full working condition until June, 1915.

The report of Commissioner Hartwell, accompanied by that of Herbert B. Allen, chemist in charge of the disposal plant, for the year 1919 is of interest and value to sewerage engineers and officials, a special feature of interest being the cleaning out of the Imhoff tanks, the reason for it and the information obtained thereby.

IMHOFF TANKS

"Investigations while pumping sludge from the Imhoff tanks seemed to indicate that there was considerable matter in these tanks that was not being moved or lifted by the air-lift. As none of the five tanks had been emptied since put in service in October, 1914, it seemed best to empty one or two of the tanks in order to study their condition." Tanks 1 and 2 were cut out of service during the winter of 1917-1918, and on examination to discover why water broke through to the sludge pipe inlet before any considerable part of the sludge had been removed from the hopper, it was found that the hoppers were nearly full of inert solid matter. It had been known for some time that grit was being deposited in tank number 5, as evidenced by the material found on the slopes of the sedimentation compartments and the difficulty encountered in starting the flow of sludge in the end hoppers when beginning to pump. It was accordingly decided to clean this tank first and it was cut out of service on April 2 and allowed to stand with a view to securing complete digestion of the sludge before cleaning it.

It was decided to pump sludge from time to time as it became digested, but no sludge could be lifted from the end hoppers, although it was possible to do so from the middle one. Upon applying a jet of water from a 1-inch hose that was lowered through the sludge pipe while the compressed air was on, some sand and pebbles as large as small plums came out, together with water from the hose, but no sludge. The tank was then pumped down to the sludge, but it was found impracticable to pump the sludge with either a diaphragm pump or a pulsometer. An attempt was made to pump the sludge with a 6-inch Koerting water jet eductor, with Siamese connection to two lines of fire hose attached to hydrants, but the opening was found to be too small. Then a Hancock ejector with an opening of about 1½ inches between the end of the nozzle and the outer edge of the discharge tube and a 2.3-inch throat was purchased and worked very satisfactorily when the solids were flushed into it through a screen of ¼-inch mesh.

After pumping out all the liquid sludge which would flow to the ejector, solid matter remained in hopper number 1 which was calculated to have a volume of 145.1 cubic yards. The matter found in hopper number 2 was calculated at 92.7 cubic yards, and that in hopper number 3 at 129.1 cubic yards; making a total volume of solid matter in the three hoppers of 366.9 cubic yards. The cost of labor involved in removing this material by means of the ejector was $232.90, equivalent to 63.5 cents per cubic yard removed. The end hoppers contained large proportions of grit, including pebbles and cinders of considerable size. The middle hopper contained comparatively little grit, but the material was quite solid and dense.

Tank number 5 was put into operation again on September 17, being seeded with 1,675 gallons of sludge from tank number 4, and good gas action was apparent on September 20. Scum began to form immediately, although it consisted at first very largely of undigested material.

On August 30, tank number 2 was cut out of service, the liquid matter removed and afterward the solid matter as in tank number 5. In this tank 191.6 cubic yards of solid material were found in the first hopper, 175 in the second hopper and 158.3 in the third hopper; making a total of 524.9 cubic yards in the tank. The cost of labor for cleaning this tank was $231.48, or 44.1 cents per cubic yard of solid matter removed. The solid matter in this tank was practically free from grit, but was sticky and pasty in consistency, which condition was believed to be largely due to the presence in the sewage of wash water from the coating room of a paper company, which contains lime, casein and glue. There was also nearly a cubic yard of material removed by buckets, most of which was concrete which had fallen into the tank when repairing chimneys in 1915. This tank was put into operation again on October 23.

From the information obtained by these cleanings, Mr. Hartwell concludes that it would be desirable to clean one or two of the Imhoff tanks each year.

The presence of so much grit in these tanks is undoubtedly due to the fact that a considerable part of the sewerage system of Fitchburg is on the combined system. All new sewers connected with the treatment plant are laid on the separate system, and some of the old ones have been changed over to this system and it is the aim to carry on this change to the separate system as rapidly as finances and circumstances permit. For the present, however, it is necessary to operate the system with this handicap of the introduction of storm sewage and its accompanying grit and other street washings.

The Imhoff tanks were in continuous operation through the year except upon five separate occasions totaling 3.33 days, at which times a blow-off from the siphon to the river was wide open for the purpose of drawing down the Imhoff tanks to receive secondary tank sludge or for cleaning and repairs. This blow-off is also opened partially during times of excessively high storm flow to protect the tanks from an undesirably large amount of storm water, this having been done fifty-three times during 1919, generally for only a few hours.

The total quantity of sewage treated by the tanks was 1,219,901,000 gallons, or an average of 3,351,380 gallons a day. The computed periods of detention of sewage in the tanks ranged from 4 hours and 5 minutes in May, to 9 hours and 30 minutes in October, with a minimum rate for only 24 hours of 3 hours and 48 minutes on March 26 and a maximum of 20 hours on October 12. The flow through the tanks was reversed at the beginning of each monthly period, with the exception of the beginning of April.

The average monthly removal of settleable solids as shown by the Imhoff glasses varied from 96.02 per cent in July to 99.99 per cent in November, averaging 98.04 per cent for the entire year. The removal of total suspended matter has varied from 47.6 per cent in April to 84 per cent in September, averaging 66.5 per cent for the year. The amount of total dry solids removed was 823.7 tons. In addition to this, 62.1 tons of dry solids were added in the form of sludge pumped from the secondary tanks, making a total of 885.8 tons of dry solids deposited as sludge in the Imhoff tanks.

The percentage of settleable solids removed was higher and more uniform than in previous years on account of more careful skimming of the tanks and keeping the slots and the slopes leading to the slots in a cleaner condition. The systematic flushing of the surface of the tanks during warm weather also tended to increase the percentage of settleable solids removed and at the same time maintained a more satisfactory appearance of the tanks.

The grease and other material floating on the surface of the tanks was removed about three times a week on the average, the total quantities so removed amounting to 18.8 cubic yards, or an average of 1.4 cubic feet per day.

The level of sludge in the Imhoff tanks was determined frequently by the use of the Pitcher pump with graduated suction hose and whenever the sludge was found to be too near the slots it was lowered by pumping.

The gas vent chimneys of the Imhoff tanks have been gradually disintegrating above water level and last year the tops of six of them were rebuilt with 4-inch brick walls washed with cement grout.

At two or three different times during the summer when sludge digestion was most active, excessive foaming was experienced in the chimneys of tanks 1 and 2, making it necessary to apply the hose to prevent them from overflowing. This foaming was attributed to the large volume of secondary tank sludge that had been pumped into these tanks, but it seems probable that the underlying cause was the restricted capacity of the sludge compartments resulting from the accumulation of solid inorganic matter in the hoppers which could not be removed by the air-lift. Early in the spring, when pumping of the Imhoff tank sludge was resumed, it was found that the sludge in these two tanks was not well digested, which probably was due both to the accumulation of solid matter referred to and also to the large volume of secondary tank sludge which was pumped into these tanks. The warm weather which followed soon after so facilitated sludge digestion that it was necessary only to pump out a comparatively small volume of undigested sludge.

The dosing tanks were cleaned twice during the year, in May and October, a total of 7.8 cubic yards of sludge being removed from the bottoms of the tanks. The apparatus worked well except once or twice when it was necessary to flush out the air pipes, which had become clogged with growths.

SPRINKLING FILTER

The trickling filter, or sprinkling filter, received the entire Imhoff tank effluent, except on four occasions totaling 24 hours while tank number 5 was being pumped down. The rate of treatment averaged 2,690,000 gallons per acre per day. On November 30, 1918, seven distributing lines on one side of the filter were shut off, flushed and drained, and this portion of the filter was allowed to stand idle during the entire year in order to determine whether the filter could operate at a rate sufficient to accommodate the increase in population for several years to come. This reduced the working area from 2.108 acres to 1.24 acres, and the computed increase in load was approximately 70 per cent. In spite of this, there was no material increase in pooling of sewage on the surface of the filter or in accumulation of organic growth, and nothing was done to the surface of the filter except loosening the top stones during the winter on a few small areas where slight pooling was in evidence.

Spiders were very thick about the filter in the early spring, but during the remainder of the season neither spiders nor flies were troublesome.

The total number of full-size nozzles in use during the year was 265. These were kept clean even more thoroughly than before, the number of cleanings averaging 22.2 per day. The increased frequency was due both to more careful attention and to the increased volume of sewage applied per nozzle. The distributing lines were drained and flushed three times during the year, which operation greatly reduced the nozzle clogging and it is proposed to make this a regular practice in the future.

The unloading of the solid matter stored in the filter during the winter months began about April 10, earlier than usual on account probably of the open winter and early spring. The rate of unloading, as computed from the suspended solids in the trickling filter effluent, shows that the maximum unloading occurred during the week ending May 29, when the effluent contained a total of 18,800 pounds of suspended solids, equivalent to 215 per cent of the average. The minimum quantity of suspended solids discharged occurred during the two weeks ending December 12th, when it was 40 per cent of the average.

Owing presumably to the increased load on the filter, its efficiency was slightly less than for the preceding year. The average flow treated was 20 per cent greater than for the preceding year and the area was reduced 41 per cent. This resulted in an increase in load which, measured by the different constituents, ranged from 98 per cent to 184 per cent. In spite of this, the effluent has been very satisfactory and all daily samples of the final effluent has been found stable by the methylene blue test, for the full period of fourteen days.

SECONDARY TANKS

In April, a T and valve were inserted in the sludge pipe in each of the secondary tanks, permitting the removal of the liquid matter down to the top of the conical bottom before beginning pumping of the sludge. This did away with the pumping of 30,000 gallons of top water when cleaning the tank, and the sludge without the admixture of this top water settles more readily when pumped to the Imhoff tanks. This materially reduces the cost of operation of cleaning the tanks. In cleaning the tanks, sludge is pumped from the bottom of the cone until water appears at the pump; then, using the new T, the water is drawn down to the top of the conical bottom; finally, the remainder of the sludge and water, together with that used in washing down the tank, is pumped to the Imhoff tank. The secondary tank is then put into operation again.

During the mild winter of 1918-1919 very little trouble was experienced with the formation of ice on the surface of the tanks.

The total quantity of sludge removed from the four secondary tanks during the year was 360,078 gallons, containing 93.28 tons of dry solids, of which 62.07 tons of dry solids was pumped to the Imhoff tanks for digestion. The specific gravity of the sludge varied from 1.007 to 1.035, averaging 1.020. The percentage of solids in the sludge varied from 4.07 to 7, averaging 6.11. The percentage of organic matter in the total solids ranged from 45.26 to 48.19, averaging 47.12.

SLUDGE BEDS

During the year the eleven sludge drying beds received 499,585 gallons of sludge, containing 234.77 tons of dry solids. They were cleaned from three to five times each and there was removed from them 944.06 cubic yards of dried sludge. In addition, 913,140 gallons of sludge containing 406.01 tons of dry solids were pumped to a low area known as bed number 12.

The sludge pumped during the early part of the summer had a slight undigested odor which is explained by the condition of the tanks as described above. The sludge as removed from the drying beds has varied in percentage of total solids from 26.40 to 93.30, averaging 54.25; and the organic matter ranged from 36.21 to 54.62, averaging 44.98. The weight of dry sludge has varied from 1,006 pounds to 1,735 pounds per cubic yard, averaging 1,422. Mr. Allen states that it will be necessary to increase the sludge bed area at least 50 per cent in order to handle all of the sludge from the Imhoff tanks, including that from the secondary tanks.

EFFICIENCY OF THE TREATMENT

The report gives weighted average monthly analyses of sewage and effluents for the year, and averages for the entire year. Analyses were made from sterilized weekly composites of daily samples taken hourly between 7 a. m. and 6 a. m., sulphuric acid and formaldehyde being used as sterilizing agents.

Free ammonia was increased 5.02 per cent from crude sewage to Imhoff tank effluent, and was decreased 57.4 per cent from Imhoff tank effluent to sprinkling filter effluent, with no further decrease in the final effluent. The dissolved albuminoid ammonia was increased 1.6 per cent between crude sewage and Imhoff tank effluent and was decreased 47.9 per cent between Imhoff tank effluent and sprinkling filter effluent, and a further 4 per cent between the latter and the final effluent. Suspended albuminoid ammonia was decreased 54.8 per cent between crude sewage and Imhoff tank effluent, a further 38.1 per cent between Imhoff tank effluent and sprinkling filter effluent, and a further 29.5 per cent between the latter and the final effluent, Nitrites in the crude sewage averaged .076 parts per million, .167 in the Imhoff tank effluent, .23 in the sprinkling filter effluent and .248 in the final effluent. Nitrates increased from .728 in the crude sewage to 7.119 in the sprinkling filter effluent and 7.270 in the final effluent. Chlorine averaged 62.1 in the crude sewage, and 62.2 in each of the several effluents. Oxygen consumed (total, digested thirty minutes in boiling water) averaged 143 in the crude sewage, 89.7 in the Imhoff tank effluent, 58.4 in the sprinkling filter effluent and 52.6 in the final effluent. The total residue on evaporation averaged 576 parts in the crude sewage, 413 in the Imhoff tank effluent, 351 in the sprinkling filter effluent and 334 in the final efflenut; 304 parts of the last being dissolved and 30 parts suspended.

Taking the complete plant, from crude sewage to final effluent, the free ammonia was reduced 55.3 per cent, dissolved albuminoid ammonia 49.2 per cent, suspended albuminoid ammonia 80.3 per cent, oxygen consumed 63.2 per cent, residue on evaporation, total 42 per cent, dissolved 9 per cent, suspended 87.6 per cent.

GRIT CHAMBERS AND SCREENS

There are two grit chambers along the line of the intercepting sewer used to intercept sand and grit and prevent its reaching the inverted siphon and the treatment plant. These chambers were cleaned five times during the year and there was removed from them 243.87 cubic yards of material. In addition, there was removed 37.1 cubic yards of grit at the grit chamber in the pumping station. At the upper end of the siphon is a siphon chamber and in this a screen intercepted 28 cubic yards of screenings during the year, while a screen in the pumping station removed 7.8 cubic yards. The cost of removing and disposing of the screenings from the grit chambers averaged $3.89 per cubic yard. The material removed apparently contained a smaller percentage of organic matter than in previous years, being less offensive in odor. The material removed was dumped upon low land.

The siphon chamber screen is in the form of a rack with openings 1⅝ inches wide. It is raked twice a day and the screenings disposed of by burying in the ground. The total cost of caring for the screen and disposing of the screenings averaged $6.52 per cubic yard of screenings removed.

PUMPING PLANT

The sewage from the South Fitchburg district has to be pumped to the siphon line, and two centrifugal pumps are used for this purpose. Prior to June 1 the cost of operating and maintaining a pumping station was charged against the treatment plant, but after that it was charged to the sewer maintenance account. During the six months ending May 31, the total cost of operating the pumps was $2,238.34, of which power and repair to pumps cost $1,271.33, supervision and raking of screen, $40.86; removal of grit, $240.57; and overhead, $685.58. With the construction of storm water drains in this district the cost of power for pumping was greatly reduced. The grit chamber was constructed in August, along with some other improvements, and since then the pumps have been more efficient, and it is expected that the efficiency and economy of operation will be further increased by the proposed elimination from the sewage of large quantities of wash water from the paper plant containing lime, casein and glue. These pumps work most efficiently at the normal flow of four to six million gallons a day, the efficiency decreasing if the flow falls below or rises above this rate.

CARE OF GROUNDS

Considerable attention has been paid to improving the appearance of the grounds in which the plant is located. During the months of April and May, 1919, the Park Department trimmed all of the shrubs about the grounds, spraying with lime and sulphur those which showed signs of blight, set out rock maples to take the place of those that had died, and put in a few Norway spruces on the drive leading to the Imhoff tanks. Most of the shrubs and trees set out in previous years are still living. During the year the roads were all cleaned once and the weeds removed around the shrubs. The roads leading to and about the plant were coated with Tarvia and sand in the fall of 1919 and needed no further attention. During the year the fences bordering the main roadway were painted.

COST OF OPERATION

The total cost of operating the sewage treatment plant (exclusive of the pumping station by which low-level sewage is lifted to the plant) was $11,596.07, equivalent to $9.56 per million gallons of sewage treated, or to 30.3 cents per capita served. This is materially greater than in 1918, partly because of the increased cost of labor and material but principally owing to the cost of the cleaning of the Imhoff tanks and repairs and improvements made. (This does not include the $31,000 interest and sinking fund expenses for the plant as estimated in the opening paragraphs of this article.) This total cost is divided as follows:

Grit chambers, $1,340.80. Siphon chambers, $263.82. Imhoff tanks, $5,222.20. Sludge beds, $1,026.60. Trickling filter, $1,899.04. Secondary tanks, $1,843.61.

The cost of operating the several subdivisions of the plant is divided in the accounts as follows: Imhoff tanks—cleaning and repairs, $838.70; repairing and power for pumping, $1,026.22; watching and sampling, $1,757.60; and overhead, $1,599.68. Trickling filter—repair, $443.49; watching and sampling, $873.80; overhead, $581.75. Secondary tanks—repair and power for pumps, $101.75; watching and sampling, $873.80; improvements, $303.36; overhead, $564.70. Sludge disposal—cleaning beds, $712.35; other charges, $314.25.

Classifying the maintenance accounts in another way, the expenses are given as follows: Administration, $760.75; laboratory, $988.43; grit and siphon chambers, $1,112.75; Imhoff tanks, $3,622.52; trickling filters, $1,317.29; secondary tanks, $1,278.91; sludge beds, $712.35; care of grounds, $920.76; pumping station, $1,552.76; supplies, $134.67 miscellaneous repairs and expenses, $1,433.22.

The Miles-Acid Process on Tannery Waste

By E. S. Dorr*

The author, in a paper before the American Society for Municipal Improvements, tells of an apparently successful test, with by-products valued at $300 per million gallons of waste water.

In June, 1916, a sample of tannery waste was submitted to the Miles-acid process. The sample was very high-colored and was heavily charged with organic and mineral matter, 6,449 ppm, of which 4,866 were mineral and 1,583 organic and volatile. Upon the application of sulphur dioxide the waste cleared in about five minutes and was well settled in half an hour. The dark blackish-red color was bleached to straw color, the SO_2 used was at the rate of 860 ppm (7,167 lbs. per mg). Probably 900 ppm (7,500 lbs. per mg) would be advisable to secure sterility Bacterial reduction was not noted.

The odor was completely killed.

The reduction in the organic and volatile matter, including suspended solids, was 50 per cent.

The precipitated sludge was at the rate of about 4 tons (dry) per million gallons with a grease content of 16.88 per cent and ammonia content of 7.50 per cent in the undegreased and 9 per cent in the degreased sludge. In pounds the amounts are 6,640 lbs. degreased sludge, or fertilizer material, and 1,360 lbs. grease.

The fertilizer with 9 per cent ammonia at $7.50 per unit (value of tannery tankage in August, 1920) would be worth $67.50 per ton, or 3.3 tons would be $222.75 per million gallons.

The grease at the prices assumed in the New Haven investigation (and tannery grease is probably worth more) would be worth, at 5 cents per pound, $68 and at 8 cents per pound $108.80 per million gallons. So that the total value of grease and fertilizer would run from $290.75 to $331.55 per million gallons treated, according to the quality of the grease. (The free fatty acids were 48 per cent, percentage of unsaponifiable was not determined.)

On the other hand, the cost of operation would be high. About five times as much acid would be required, and twenty times as much sludge per million gallons would have to be handled, as at the Boulevard sewer in New Haven. The cost of operation at that outlet was reckoned at $20.98 per million gallons, of which $10.74 was for acidification, as the flow was not large, about 6,000,000 gallons per day. The New Haven figures may be taken as a basis for estimating the probable cost of handling tannery waste. Correcting, in the ratios indicated above, for the heavier tannery waste, the cost per million gallons would be $161.22.

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The values of the products have been figured above at from $291 to $331 per million gallons treated. The estimate therefore shows a surplus of values over costs of $130 to $170 per million gallons.

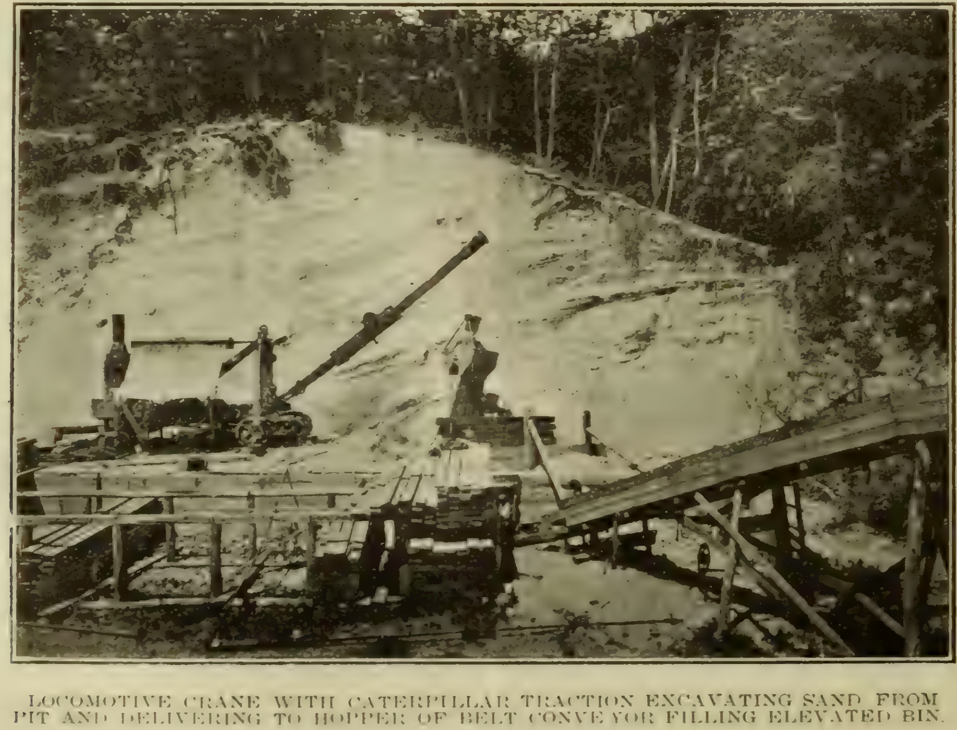
In view of the fact that, so far as the writer is aware, no revenue has been obtained from tannery wastes, but, on the contrary, they are a source of expense for disposal, it would seem that this process is worthy of the attention of tanners. In addition, the facts that the sludge and effluent are inodorous, that the color is so bleached that with reasonable dilution it would not be noticeable except close to the outlet, and that the effluent is sterile or can be made so by the addition of acid (for the cost of which there is ample margin between values and costs) should still further commend it to attention and experiment.

Huntington-Cold Spring Harbor Road Construction

Six miles of 20-foot concrete pavement built at an average rate of 350 linear feet per day with small labor force and special equipment. Materials stored by mechanical plant and delivered by gravity to motor trucks carrying multiple batches 1 to 6 miles to load concrete mixer direct.

The New York State road from Huntington to Cold Spring Harbor, Long Island, has a standard concrete pavement 20 feet wide and 6 miles long, built under the direction of the State Engineer of Highways by the R. W. S. Corporation, contractor. The work has been executed with unusual economy and rapidity, largely due to the good judgment and liberal policy of the contractor, who made a thorough preliminary study with special reference to the use of improved equipment for expediting the work and reducing its cost. Suitable and up-to-date plant was selected and installed, methods were determined, and operations were scheduled in advance of the beginning of the work, which has been carried out very satisfactorily in accordance with the program.

The principal features have been the mainte-

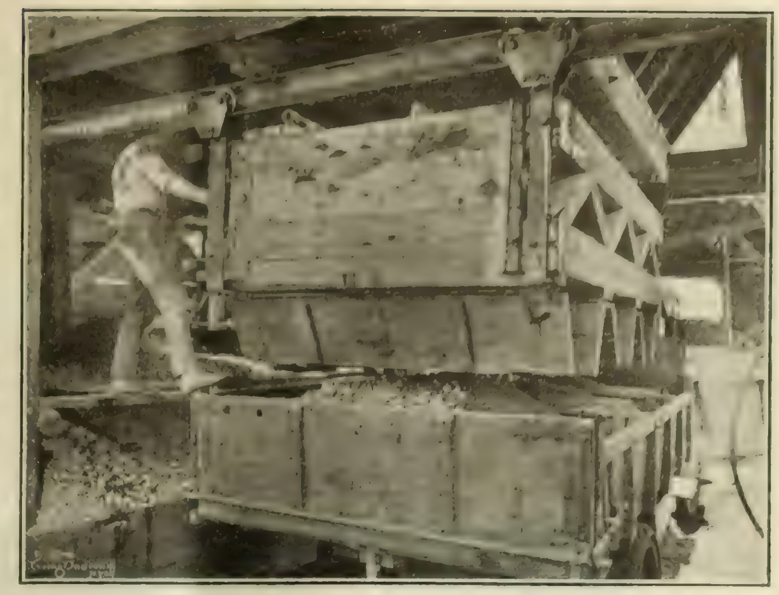


LOCOMOTIVE CRANE WITH CATERPILLAR TRACTION EXCAVATING SAND FROM PIT AND DELIVERING TO HOPPER OF BELT CONVEYOR FILLING ELEVATED BIN.

nance of abundant supplies of aggregate and cement, economical handling in storing and reclaiming it, rapid and accurate measurement and delivery of material as used, and transportation of multiple batches by motor trucks from the central storage plant to a large mixer so as to enable it to maintain unusual continuity of operation.

STORAGE

Broken stone from Tompkins Cove was delivered by barges to a dock at Huntington, where it was unloaded by a 50-foot stiff-leg derrick boom and 1-yard clam-shell bucket that delivered it to an elevated storage bin of 20 yards capacity, which was kept full to supply the constant demand of the concrete mixer. The capacity of the bin being much less than the amount maintained on hand, the surplus, as unloaded from the barges was piled on the ground opposite the bin and reclaimed from the piles and loaded into the bin by the derrick, which performed this service in otherwise idle time, thus practically eliminating the cost of rehandling, and making the entire quantity stored available through the small storage bins.


LOADING 3-BATCH MOTOR TRUCK FROM MEASURING BOX UNDER STONE AND SAND BINS.

A sand bank, fortunately located adjacent to the dock, was excavated by a ½-yard clam-shell bucket operated by a Byers locomotive crane with a 50-foot boom that excavated the bank with a face about 50 feet high. As the capacity of the crane was considerably greater than required for the daily consumption, it was only operated about 1-3 of the time, requiring the continual services of one fireman and half of the time of the operator, who also ran the unloading derrick.

DERRICK AND BELT CONVEYOR DELIVERING BROKEN STONE AND SAND TO LOADING BINS.

The sand was delivered by the clam-shell bucket to a 24-inch belt conveyor 150 feet long driven by an 8-h. p. gasoline engine that elevated the sand about 25 feet and delivered it into a 20-yard elevated storage bin adjacent to the stone bin.

MEASURING AND LOADING

Each of the two hopper-bottom storage bins was provided with three horizontal bottom sliding gates placed to correspond with three compartments in a movable measuring box mounted on an overhead track below the bottoms of the bins.

This box was first spotted under the stone bin and received simultaneously three 18-cubic-foot batches of stone. The box was then pushed by hand about 10 feet to position under the sand bin, which similarly discharged into it three 9-foot batches of sand, all loaded by two men in 20 seconds.

An automobile truck with the body divided into three compartments, corresponding with those of the measuring box, was then spotted directly under the measuring box and the double flap bottoms of the compartments in the latter were simultaneously opened, delivering the sand and stone to the batch compartments in the truck. The truck was then taken to the adjacent cement storage house where, from a platform level with its top, 6 bags of cement were emptied by hand into each compartment. In this way each truck was loaded with materials for three 33-foot batches of 1:1½:3 concrete

A fleet of 8 Brockway 3-ton trucks with automatic dumping bodies hauled all of the materials to the mixer, from 1 to 6 miles distant, at an average rate of about 150 yards hauled 5 miles in 8 hours. The cement was loaded into the trucks by 4 men in 40 seconds and the average time consumed in loading a truck with stone, sand and cement was only 1½ minutes. At the loading plant two laborers were employed in the sand bin, two to operate the measuring box underneath the storage bin, and four handling the cement, besides the two derrick firemen and the machine operator already mentioned. When a barge of cement was unloaded an additional force of six or seven men and a small gasoline hoist were required.

MIXING

Concrete was mixed in a 12-ton Foote machine mounted on a multifoot traction having two 10-foot 6-inch x 14-inch treads which reduced the load on the surface of the ground to about 1,000 pounds per square foot and enabled the machine to advance under its own power without tracks or platforms and to run over grades and rough or soft ground. Usually the machine advanced about 15 feet at a move, which was made in 1 minute. The machine was driven by a 45-h. p. Twin City 4-cylinder tractor engine. It required only a single man to operate it. The ordinary time for mixing was about 1 minute per batch of 23 cubic feet, which was spouted through a 15-foot chute to position on the grade and spread and finished by hand. The machine was advanced about every 4 or 5 batches and made a record of 225 cubic yards in one 8-hour day.

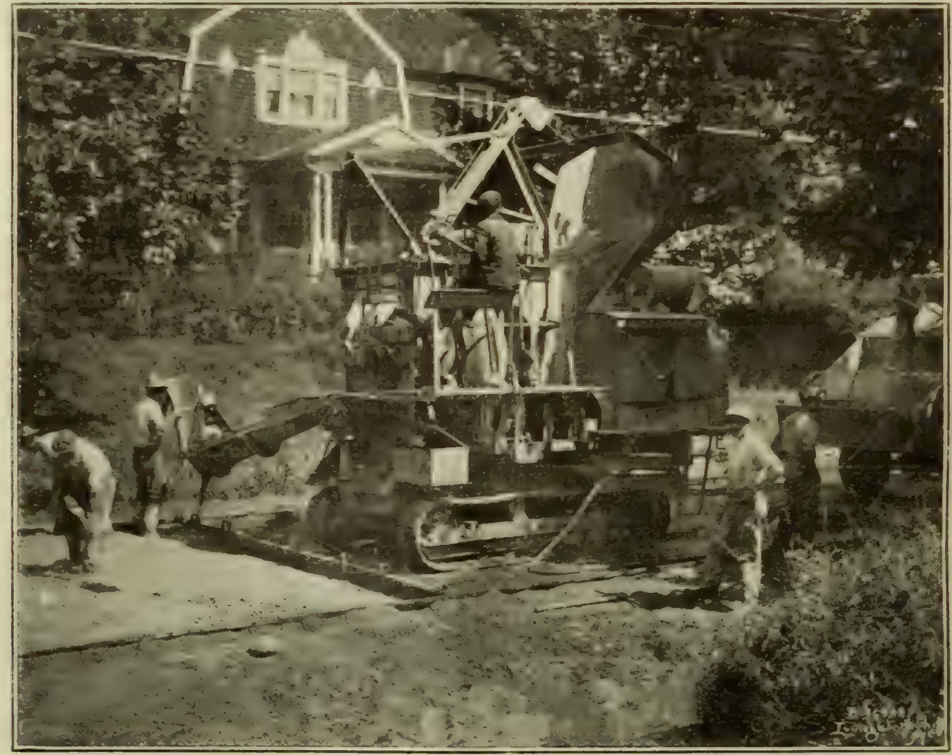
The mixing machine was protected by a bumper log placed on the ground against which the trucks backed up and deposited their contents in the elevating charging hopper of the machine. The three batches were discharged from the truck in about 5 minutes and the truck withdrew, leaving one batch in the drum and one in the hopper.

Each truck body was divided into three batch compartments by two vertical transverse partitions and a tail board, each swinging on pivots at the upper edge, and controlled by an outside latch and lever that held it in position until it was released, when the weight of the materials opened the gate, which automatically returned to closed position when the truck body was lowered. Usually the trucks dumped very freely without help, and only require to be scraped occasionally in very wet weather.

The concrete was finished with a hand roller and with a belt. As soon as the concrete was one day old it was covered with 3 inches of earth and kept moist for one week by use of a hose. Water for the mixer was pumped from a lake by a Domestic gasoline pumping unit with a capacity of 60 gallons per minute, which delivered through a maximum of 10,000 feet of 2-inch pipe, and for the latter part of the job, where no water was available from city supply, worked constantly to fill the demand.

At the mixer two men were employed dumping trucks, five men behind the mixer placing and finishing concrete, three men on forms, two men on sub-grade, one man operating the pump and two men covering and wetting the finished concrete.

The average production per 8-hour day was about 350 linear feet or a little more than 150 cubic yards. The best day's run was 494 linear



ELEVATING HOPPER CHARGING SECOND BATCH FROM TRUCK IN REAR feet or about 225 cubic yards in 8 hours. On many days 400 to 500 linear feet of pavement were made.

PREPARATION OF SUBGRADE

The new road replaces an old macadam road 18 feet wide, the surface of which was first broken up with a scarifier hauled by the 10-ton Buffalo-Pitts steam roller used for compacting the ground to sub grade. After scarifying, the ground was loosened by a road plow hauled sometimes by teams and sometimes by a road roller, and was excavated to a maximum depth of 6 inches by six Meaney wheel scrapers hauled by teams or hauled sometimes by the road roller. The total excavation amounted to about 4,000 yards, most of which was used in building the shoulders of the new road. The concrete was placed in 8-inch Blaw steel forms, about 2,000 linear feet of which were used.

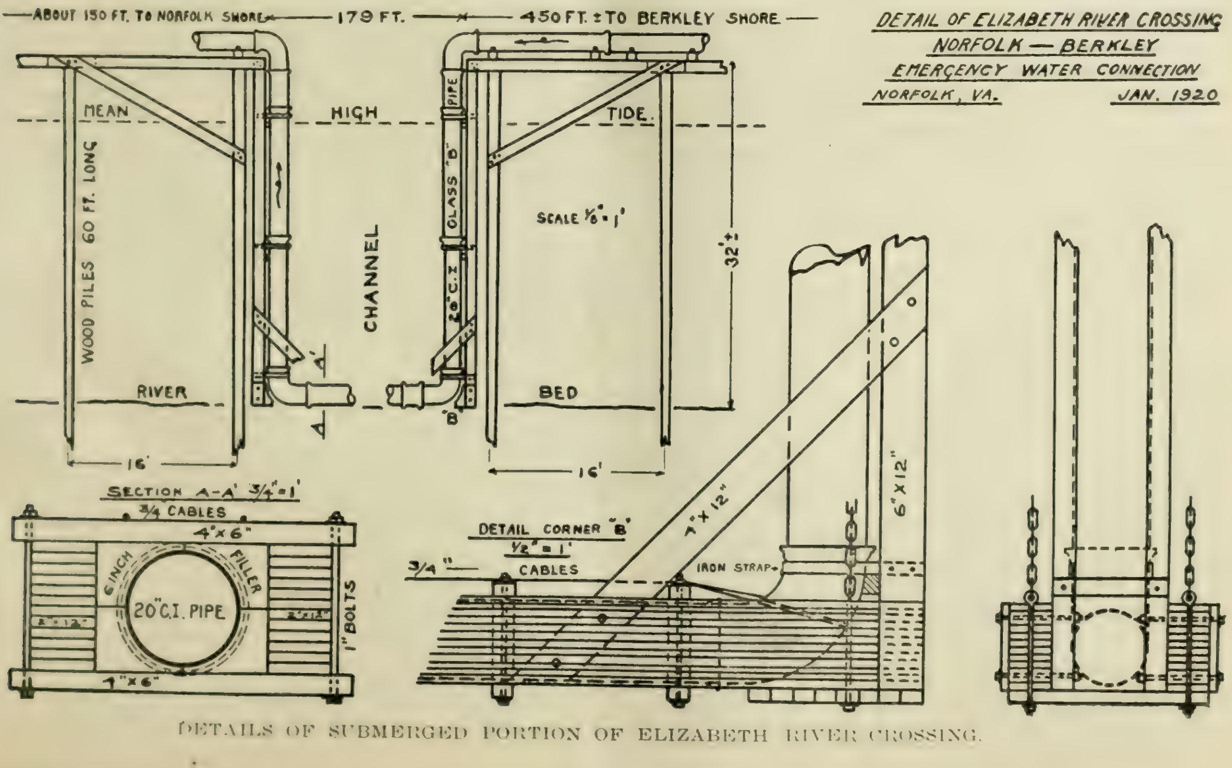
The work was commenced in April and finished about the first of August, the road being opened for traffic in the middle of August. A total force of 21 men, including truck drivers, was required and the work was rapidly prosecuted notwithstanding a delay of 15 days due to several truck drivers' strikes and 10 days or more due to rainy weather when no work was attempted, thus causing a loss of about 1 month in the elapsed time. Assistant Engineer Schultz, in charge for the State, considered it the most rapidly executed work on record.

Norfolk Emergency Water Connection

This Virginia city contracted on a cost-plus basis for laying several miles of 16 and 20-inch pipe to connect with the Portsmouth-Berkley mains across the Elizabeth river. This included a submerged section under the channel of the river, the method of laying which is described herein.

Norfolk, Va., is dependent for its water supply on surface water which is stored in a number of shallow lakes or reservoirs. During the war the pre-war population of Norfolk of about 50,000 was more than doubled and its water supply became insufficient. Across the Elizabeth river was Portsmouth, and this city had a considerably larger supply of water. All of the cities in this section were considerably affected by the activities of the War Department, and that department worked on a plan whereby all the separate water supply systems of Newport News, Hampton, Old Point Comfort, Suffolk, Portsmouth, Berkley and Norfolk were to be connected and consolidated, dams of existing reservoirs raised and new lakes tied in, and when the armistice was signed the government had spent about $2,500,000 on this work, mostly on the Portsmouth side.

With the ending of the war the government dropped this work and put it up to the city to



DETAILS OF SUBMERGED PORTION OF ELIZABETH RIVER CROSSING.

solve its water problem, which remained, as the population of the city is still about double that before the war. It seemed impossible, however, to solve the problem in the way the government was planning because the different cities could not get together, each wanting its own independent water system or else a combination on terms not acceptable to the others. The following year a prolonged dry spell nearly dried up Norfolk's sources of supply, and drinking water was hauled into the town in new tank cars borrowed from the Standard Oil Company. Up to the middle of January of this year nothing had been done except to pray for rain.

As the situation had grown acute, City Engineer Ashburner secured a six months' permit from the Water Department to run a pipe line from the Portsmouth-Berkley supply main, crossing the Elizabeth river on a pile trestle, submerging the channel section only, and connecting it with the Norfolk distribution system. For constructing this line, he purchased from the War Department about 25,000 feet of cast-iron class B bell-and-spigot pipe which the department had purchased in connection with camp construction work in that locality. He also secured from the city council an appropriation of $200,000 for immediate use in securing temporary relief and an ordinance calling for an election on a $6,000,000 bond issue to establish a larger permanent supply for the city. R. B. Porter, who had just completed a large contract for the government at the army supply base, was awarded a contract on a percentage basis to rush a 16-inch and 20-inch cast-iron pipe connection between the Norfolk distribution system and the supply main from Portsmouth to Berkley. Alfred Lewald had been superintendent of sewer and water construction for Mr. Porter in his government contract, and he described the construction of this temporary connection in a paper before the Engineers' Club of St. Louis, of which he is a member. The following description is quoted from this paper.

"To connect the Portsmouth and Norfolk systems, we built a booster pumping station having two direct connected electrically driven 8-inch centrifugal pumps (which the city already had had in use elsewhere) and connected them to the Portsmouth-Berkley supply main with only a three-hour interruption of service on the same. We also laid about 4,850 lineal feet of 16-inch class B bell-and-spigot cast-iron pipe from the booster station through the town of Berkley to the Elizabeth river. The average depth of this was about 4 feet, except where we crossed salt marshes and ran the pipe on cribbing and mud sills. A 20-inch cast-iron pipe was then continued across the river on a wood pile trestle we had previously built of 60-foot piles, two-pile bents spaced about 16 feet apart. This trestle was built parallel to and on the down stream side of the Norfolk-Berkley draw bridge. Opposite to the draw span of this bridge our pile trestle was discontinued and the 20-inch water pipe dropped (as I will later explain) in the form of a U to the river bed about 30 feet below. In this way the pipe line crossed the ship channel and rose again to a pile trestle which led to the Norfolk shore. After reaching the Norfolk side, due to a great many miscellaneous obstructions, such as the Norfolk & Western Railroad yards, which we had to cross, sewers, submarine power, telegraph and telephone cables and gas mains, we had to carry our cast-iron main to a greater depth, which took us below high tide and gave us the obvious additional trouble of fighting the tide water which poured through the oyster-shell-filled ground into our ditch. The connection to the Norfolk mains was then made with a minimum interruption of service. The length of the 20-inch line was about 1,650 lineal feet, making a total of about 6,500 lineal feet of line.

SINKING CHANNEL SPAN

"I will now describe the building, launching and sinking of the U section of the line for the channel span which, with the speed of construction, were the unique features of this work.

"The bottom of the U section, including the two elbows turned upward on each end, was joined, leaded and caulked on shore. This section was 176 feet long.

"The pipe was surrounded by a timber crib, made up of two continuous beams, one on either side of the pipe, whose cross-section was 12 x 24 feet. These beams were built up of 2 x 12-inch boards laid flat, breaking joints and well spiked together. These were built about 180 feet long. Across these and the enclosed pipe, both above and beneath them, we placed 6 x 6-inch timbers, slightly lapped. Between the upper and lower 6 x 6-inch cross-timbers we put in fillers around the pipe and tied the entire section of the crib and pipe together by means of 1-inch bolts passing through the ends of the upper and lower cross-timbers. These cross-timbers were placed 3 to 5 feet apart along the entire length of the beam. A double ¾-inch cable was then run from end to end of the U, making a turn around each elbow and running over the top cross-timbers of the crib. The slack in the cable was all taken up by means of turnbuckles provided therefor. The purpose of this cable was to act partly as the tension member of a truss (the tension member being on top, as the ends of our crib would be slightly heavier due to the riser pipes of the U), but chiefly to prevent the joints being blown apart due to any water hammer that might occur. In addition, we carried vertical timbers upward behind the riser pipes of the U from the crib and knee-braced to it, and further strapped and blocked the elbows and risers to it.

"When this had been completed we temporarily bulkheaded the open ends of the elbows with boiler plate and proper fastenings, and tested the line to 90 pounds water pressure. Finding no leaks or weak pipes, we removed the water, replaced the bulkheads, and launched the crib by jacking it out uniformly at low tide on ways previously constructed. The next high tide floated the crib and pipe, which had a net buoyancy of about 12 pounds to the linear foot of crib. We then took hold of the crib with two derrick lighters, each holding it with a light line on cable slings previously attached to the crib, giving us four points of support. The outfit was then towed into position in the channel, where guide piles had been driven, two at each end, one on either side of the crib. These piles served to hold the crib in place against the tide while sinking. The crib was centered between these piles by springing the tops aside. This could easily be done, the 60-foot piles having only about 25 feet penetration. The derrick lighters were kept on the down stream side, where they were anchored and lashed to the bridge fender piles and our pile trestle. We now also took a strain at the center of the crib on a previously attached sling with the pile line of the floating driver. This gave us six points of support for the crib while sinking. Barges were ready at either end of the crib with hot lead and plenty of men, tools and materials. We now removed the bulkheads from the elbows and had a third derrick lighter place the first sections of riser into them. After these pipes were strapped and bolted to the vertical timbers, and the joints run and caulked, we pumped water into the pipe line until the bottom of the U was full. Then, slacking off a little at a time on all three rigs, and always keeping the base of the U level, we quickly sank it until the bells of the first riser sections were at a convenient elevation with respect to the barges. After this, the next sections were placed, run and caulked in the same manner. These last joints had previously had short sections leaded and caulked into them, whose approximate length had been determined by soundings. The whole was then easily lowered to the bottom. We always had complete control. A diver was ready in case of trouble to make an examination, but it was not needed. The bottom had been slightly leveled off with a clam-shell bucket. The top elbows were now placed and connections made to the trestle lines. The last two joints before joining the U were kept above the trestle to allow for settlement of the U. Later, chains which had been fastened on either side of and at each end of the crib, were fastened to the piles to prevent further settlement pulling the riser section apart. The elbows on top were strapped back and down to prevent their being blown off. Cluster piles were driven around the risers to prevent their being hit by boats.

"The channel was blocked to navigation only one half day, and as shipping had been notified, it caused little trouble. The clearance for ships above our pipe line is about 23 feet at low tide.

"We were able to turn water into the Portsmouth-Norfolk connection on January 30, just 17 days after being awarded the contract. The last three days of this time were put in during the long-prayed-for rain which had finally arrived. Our average force was about 350 men and the experience cost Norfolk close to $100,000.

"The government and city officials and the contractor all worked harmoniously and deserve joint credit for tiding Norfolk over a serious crisis."

Water Consumption in Waltham

Per capita consumption was reduced nearly one-fourth in a year by pitometer survey, stopping leaks so discovered, and metering. A large part of the loss was through stuffing boxes of underground valves.

In his report for the year ending January 31, 1920, Henry F. Beal, city engineer and superintendent of the Water, Street and Sewer Department, gives encouraging reports concerning the reduction of water waste during that year in Waltham, Mass. The total amount pumped for the year was 203 million gallons less than in 1918, decreasing the daily per capita consumption from 78.4 to 59.2 gallons.

A pitometer survey of the entire distribution system was made during May and June, and in addition 765 new meters were installed, making the system 91.2 per cent metered. It was expected that still further reduction in the waste and loss would be effected by continuing the repairing of leaks which had been located by the pitometer survey. It was calculated that the waste of water averaged 51.6 gallons per capita per day in 1918, 36.8 gallons during the first half of 1919, and 29.6 gallons during the latter half of 1919. The waste (the night loss being taken as the amount of waste) was a maximum of 62 gallons in 1913, when 25 per cent of the services were metered, and decreased gradually to 43.7 gallons in 1916 with 53 per cent of the services metered. During the next two years, although the percent of services metered increased to 76.6 per cent, the waste also increased to 51.6 gallons. That this increase was due to leaks in the system rather than waste (to a considerable extent at least) is indicated by the fact that, following the pitometer survey and the repair of leaks discovered by it, the loss was cut down to 32.6 gallons per capita per day. During 1919 the average daily consumption was 1,952,100 gallons, the maximum for one day was 2,477,900, on January 7, and the minimum, on September 3, was 1,677,200.

Following the survey of the system in May and June, the Pitometer Company, under date of June 24 submitted a report giving the following facts and conclusions:

Water is supplied to the system by two pumping stations drawing the supply from wells and pumping into a concrete stand-pipe.

The distribution system comprises 61 miles of mains from 24 inches to 2 inches in diameter.

There are 4,300 services.

The consumption is practically all domestic, business and public, with only a small amount of manufacturing; under which conditions, if the system were fully metered, the consumption should be as low as in the neighboring suburban cities of the Metropolitan Water District, or about 45 gallons per day.

The survey located some large sources of loss, among these being 250,000 gallons a day lost from leaking stuffing boxes of underground valves. Also 115,000 gallons a day from leaks discovered brought the total up to at least 400,000 gallons. Watering troughs were reported as a source of unnecessary waste, from 20,000 to 35,000 gallons per day being used at each, which was considered much more than was necessary. The leakage around valve stems was reported by districts, four in one district leaking at a total rate of 55,000 gallons a day, four in another district at 40,000 gallons, three in another district at 44,000 gallons, and twelve in another wasting 120,000 gallons per day.

Two 6-inch compound meters were found to be under-registering, one of them 13 per cent and the other 2½ per cent. Other large meters, 24-inch and 12-inch, however, were found to be registering correctly. Of the two pumps, one was found to have no measurable slip, while the other showing a slip of 7.5 per cent.

Comprehensive Water Development for California

A plan for the solution of the water problem of northern California has been proposed by Col. Robert B. Marshall, who was for several years connected with the U. S. Geological Survey. This plan was proposed in March, 1919, in an open letter to Governor Stevens, since which time Col. Marshall has been perfecting the details of the project and making it known to the citizens, and it is expected that it will be presented next winter to the State Legislature.

The plan includes the construction of a series of storage reservoirs in the mountains, with canals on both sides of the Sacramento and San Joaquin valleys, and the reclamation of all available land in these and adjacent valleys, estimated at approximately 12 million acres. Under present conditions the project is estimated to cost between 600 million dollars and 750 million dollars, or a tax of about $50 to $60 an acre on the land reclaimed. It is believed that it would add to the wealth of California ten or fifteen times the cost of the project, while an equal amount would be contributed by the water power development and industrial stimulus. It would also solve the Sacramento river flood problem and provide an adequate municipal supply for the cities around San Francisco bay, Los Angeles and even more distant cities for the next one hundred fifty years. City Engineer M. M. O'Shaughnessy of San Francisco approves the project, referring to the fact that, owing to the depletion of underground waters in Santa Clara valley, the well water condition there is serious, while the orchards will be destroyed unless the level of the ground water can be preserved. He writes that the irrigation development up to date has been confined to efforts by individual corporations and a few local districts, but no broad, comprehensive plan has been considered for the last thirty years and he believes that the time is now ripe for a comprehensive study, including storage reservoirs on both higher and lower levels, hydro-electric power possibilities, canal and other irrigation distribution, and careful estimates of the amount of water available in the different localities. Mr. O'Shaughnessy concludes by stating that California can sustain a population of thirty million people with the proper storing and distribution of the water resources.

To Investigate Elizabeth's Water Supply

The Rotary Club of Elizabeth, N. J., on September 29, on the recommendation of a committee which had previously been appointed, adopted resolutions stating that it viewed with great concern the conditions in regard to the water supply of that city (which is furnished by a private company) and that the mayor and city council be urged to take immediate action.

The committee reported that for some time past actual shortage in the supply had been avoided only by borrowing from neighboring communities and because of the abundant rainfalls of the past three years. Neither of these can be depended upon in the future, and immediate provision is necessary to guarantee a sufficient supply to the city. It recommended that experts be employed to advise with the city as to how the condition can best be met. The water company has stated that it is unable to finance any scheme for an increased supply and it was therefore suggested that the city either purchase the entire plant and rights of the Elizabethtown Water Company or that it finance extensions to be made by that company.

Virginia Highway Statements

The Travelers' Protective Association, Post A, recently asked the state highway commissioner of Virginia, G. P. Coleman, to publish detailed information concerning the activities in his department. With this end in view, Commissioner Coleman has divided the state into sections and has announced that he will give to the newspapers of each section periodical reports upon the roads built in such section.

Sections of roads in the state system which have hitherto been improved by either the counties or the state are now being maintained by the department from the automobile fund, but 75 per cent of the roads are unimproved, and no provision has been made by the general assembly for maintaining them. Practically no funds were available for highway work until the fall of 1919 and the beginning of 1920. Under the previous method of road building, short sections of highways had been built here and there but not connected up, and the connecting up of these into continuous routes will not be possible until funds have been provided that can be used for this purpose.

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Sewage Treatment Experience

Experience in any line is the best teacher when it is properly apprehended and taken advantage of; and this should apply to sewage treatment as to other matters. Unfortunately, in the United States experience with operating sewage treatment plants has probably been the basis of less advance in the science and art than has that obtained in experimental plants. And yet there can be no question that experience in the former could and should be more reliable and instructive than knowledge obtained from the comparatively short runs of testing plants of temporary construction, no matter what their size. The reason for this condition of affairs is that so few sewage treatment plants are in the charge of competent men with technical knowledge and provided with sufficient assistants and opportunity to keep accurate records of the operation of the plant and study the effect of minor variations of practice in operating it. Too many plants operate without any management whatever that is worthy of the name.

One of the few exceptions to this is the Fitchburg, Mass., plant, the operation of which during its sixth year is outlined in this issue. Each year of these six has taught the superintendent of the plant some valuable lessons concerning the operation of Imhoff tanks, sprinkling filters and others of its features, which information he has generously shared with others through his annual reports. Possibly the most interesting feature of last year's experience was the lessons learned concerning the use of combined sewers for collecting the sewage treated by the plant, which sewers carried considerable grit into the tanks in spite of the use of grit basins and chambers and the presence of a long inverted siphon in the main outlet line leading to the plant; and the effect of this collection of grit in the tanks, including the apparent stimulation of foaming.

When every plant, large and small, is operated and studied with as much care and skill as this one, the science and technique of designing, building and operating such plants will advance much more rapidly and wisely.

Hydraulic Engineering

Probably at no previous time has there been under discussion anything like the number and the magnitude of projects involving hydraulic engineering as at the present. In this country, the Federal legislation designed to promote the development of water power throughout the country, and the dozen or more projects for canals, from the modest ones limited to a county to the ambitious project for bringing ocean steamers by the St. Lawrence canal to the Great Lakes, are familiar to all. There seems to be a similar spirit in European countries also, as well as in South American ones. For instance, under date of October 24 the "French Commission" (a sort of French information bureau to Americans) announces that the Commission des Forces Hydraulique reports nine million hydraulic horse power theoretically available in France, of which 1,165,000 h. p. is in use and 500,000 additional is being equipped, while six million more should be utilized within the next fifteen years, when France would, it was estimated, be third among the nations in water power development. The British information bureau in this country on the following day announced that the British government has begun an investigation into the water power resources of the United Kingdom and has already reported favorably upon nine schemes in Scotland aggregating 183,500 h. p. and recommends that England and Wales be divided into water power districts with a view to securing the best development of such power.

The utilization of these potential powers involves both promotion and engineering, and the indications are that the development of them into realities will call for a considerable amount of engineering advice and supervision during the next few years, furnishing an excellent opening for those who have made a specialty of hydraulic engineering.

Concrete and Bituminous Pavements in New York State

Under the above heading an article appeared in the September 18th issue of Public Works giving a number of figures relative to highway lettings in New York State, the significance of which appeared to be chiefly that, although the highway commission, in a report published the first of the year, estimated that the cost of concrete and bituminous macadam pavements would be about the same, bids received this year were considerably lower for bituminous macadam than for concrete; and also that there is more difficulty this year in obtaining bids on concrete than on bituminous macadam. We have just received a letter from the first deputy commissioner of the New York State Highway Department commenting upon this article, which communication we publish below.

The writer of this letter cites figures for four lettings made this year, for some reason (which he does not state) omitting all reference to lettings held on May 5, June 7 and July 2, and including that of August 10, the figures for which were not available to us when our article was prepared. This being the case, it is rather remarkable, not that Mr. Schultze's figure differ from ours, but rather that there is so much similarity between them.

Taking the first point, that of cost; his figures show that the average of the low bids at these four lettings was $34,925 per mile for concrete and $18,894 for bituminous macadam. Disregarding the two completion contracts, the bituminous macadam averages $24,330. Making allowance for the different widths of pavements as closely as the figures at hand permit, it appears that the concrete pavements averaged about 15 per cent wider than the bituminous macadam, and adding 15 per cent to the bituminous macadam price, this becomes $27,980 per mile, which is still considerably less than the $34,925. Consequently, the figures of Mr. Schultze's four lettings seem to prove the same point brought out by our figures for all six lettings, that New York builds bituminous macadam highways for much lower cost than it does concrete.

As to the other point, the percentage of bituminous macadam and of concrete projects, respectively, which were bid upon at these lettings, the figures based upon Mr. Schultze's four lettings do not vary considerably from ours for concrete and water-bound macadam, but do vary for bituminous macadam. This might be accounted for by the figures of the three lettings omitted, but as a matter of fact is affected considerably by a difference between his figures and ours for the letting of of March 18, which we are not able to reconcile. His figures show 21 projects in the letting and only 11 bid upon. In the issue of Public Works of April 3 we have given, as received from the department, bids received at this letting which seemed to indicate that of 14 cement concrete contracts offered, 8 were bid upon and that of 6 bituminous macadam contracts offered all were bid upon, instead of only 3, as given in this letter. However, the matter does not seem to us to be a vital one, since the general statement that it has been more difficult to construct concrete roads than bituminous ones during the year 1920 is borne out by the common experience of highway departments and municipalities throughout the North Atlantic states.

As to the thickness of the pavement, Mr. Schultze's letter indicates that most of the concrete pavements averaged 5½ inches thick, although occasional instances are cited of those which averaged 7½ inches. The last sentence in our article, "The bituminous macadam is understood to be 13 inches thick," was not given as a positive statement because we did not have figures showing definitely the thickness, but we had been informed by one of the engineers of the department that last year and this the majority of the bituminous macadam pavements were being made 13 to 15 inches thick.

In view of the above, we must confess that we cannot "appreciate how misleading your article is as to the comparison costs per mile."

Editor, Public Works,
240 West 39th Street, New York City.
Dear Sir:

Referring to your article in the September 18, 1920, issue of Public Works, I wish to call your attention to the following facts, making special reference to your cost per mile used:

In the four lettings helds by the New York State Highway Department, the following table shows the percentage of total mileage bid in 1920, through August 10, 1920, letting; the number of concrete bituminous and water-bound roads in each letting and the number of each type bid upon:

Letting of	Miles Bid on			Miles Not Bid on			% of Total Mileage Bid on		
	Conc.	Bit. Mac.	W. B.	Conc.	Bit. Mac.	W. B.	Conc.	Bit. Mac.	W. B.
Jan. 30 ...	10.43	20.94	15.13	38.90	5.24	0	21	80	100
Mar. 18 ...	38.99	11.82	0	23.32	14.46	6.98	63	45	0
Apr. 16 ...	8.32	2.35	8.34	17.65	10.70	0	32	18	100
Aug. 10	2.71	0	0	0	8.85	0	100	0	0
Total	60.45	35.11	23.47	79.87	39.25	6.98	43	47	77

Letting	No. of Roads in Letting			No. of Roads Bid		
of	Conc.	Bit. Mac.	W. B.	Conc.	Bit. Mac.	W. B.
Jan. 30 ...	14	4	2	6	3	2
Mar. 18	14	6	1	8	3	0
Apr. 16 ...	9	4	1	3	1	1
Aug 10	3	1	0	3	0	0
Total	40	15	4	20	7	3

At four construction lettings held previous to September 18, 1920, by the New York State Highway Department this year 43 per cent of the mileage of cement concrete pavements offered was [illegible] upon 47 per cent of the bituminous macadam mileage and [illegible] per cent of the water bound macadam. There were 40 cement concrete roads of which 20 were awarded, 15 bituminous macadam roads of which 7 were awarded, while bids were received on 3 out of 4 water bound roads.

Averaging the engineer's estimates of all of the roads and the figures of the lowest bidder for each contract awarded, we find the average engineer's estimate per mile for concrete on the 40 roads advertised to be $35,919 per mile and on the 15 bituminous roads to be $24,653. The average of the low bids on the 20 concrete roads is $34,925 per mile; on the 7 bituminous macadam $18,894. However, of the 7 bituminous macadam contracts, 2 were completion contracts with 31 per cent and 54 per cent approximately of the work done by former contractors. Disregarding these two completion contracts and averaging the low bids of the 5 new bituminous contracts, the cost per mile is $24,530.

In the January 30th letting the engineer's estimates on concrete showed an average of $33,245 for 11 roads and the low bids on 6 contracts averaged $35,813. In the March 18, 1920, letting on 14 roads the average was $35,714 for the engineer's estimate and on the 8 contracts bid the average of the low bids was $31,597 per mile. In the April 16, 1920, letting on 9 concrete roads the average of the engineer's estimates was $38,752 and for the 3 roads awarded the average of the low bids is $39,234 per mile. In August 10, 1920, letting the average of the engineer's estimates on the 3 concrete roads was $66,226 per mile and an average of the low bids on the 3 roads was $66,158. The high average was due to extra wide pavement as shown in detail later.

The average cost per mile on concrete and bituminous macadam cannot be compared on account of various factors differing for each type. For instance, in the January 30th letting, of the 6 concrete let, 2 were 16 feet wide while 4 were for greater widths up to 38 feet wide and for a short stretch as high as 56 feet. The bituminous macadam widths for three roads let were 12, 14 and 16 feet. Multiplying the length and width of each road for each type and dividing by the total length, the concrete roads show an increase in width of approximately 18 per cent. The thickness of the concrete pavements ran 5-6-5 inches parabolic on two roads and 6-8-6 inches on four and all were reinforced. The thickness of the road metal for bituminous macadam ranged from 6 inches to 12 inches.

In the March 18, 1920, letting the 8 concrete roads let were all 16 feet wide and the 3 bituminous macadam roads were 14 feet wide. All concrete thicknesses but one were 5-6-5 inches and all were reinforced while the road metal thickness on the bituminous roads ranged from 6 inches to 11 inches.

In the April 16, 1920 letting the 3 concrete contracts let were, respectively, 16, 16 and 18 feet in width and the thickness ranged from 5-6-5 inches for the smaller to 6-7⅛-6 inches for the larger width. The one bituminous road let had a road metal thickness of 11 inches and was 14 feet wide.

In the August 10, 1920, letting the 3 concrete roads let varied from 16 feet to 48 feet, with the larger percentage of widths over 16 feet. The thickness ranged from 6 inches minimum to 8¾ inches maximum.

The article in PUBLIC WORKS in the September 18, 1920, issue is open to severe criticism principally on account of the unbalanced comparison. To arrive at a cost per mile of concrete roads and compare same with a mile cost of bituminous road of lesser width gives no relative comparison and such miles costs are decidedly [illegible]. The average of the thickness on the 7 contracts awarded previous to September 18, 1920, is under 11 inches, and in no case was there a bituminous macadam contract let with a road metal thickness of 13 inches, as mentioned in the last line of the September 18th article.

With the above information at hand, you can readily appreciate how misleading your article is as to the comparison costs per mile.

We believe, however, that PUBLIC WORKS has no desire to give other than the true information, and feel sure, upon receipt of the above figures you will be glad to correct the impression which your article gives.

Yours very truly,
STATE HIGHWAY COMMISSION,
By Paul Schultze.
First Deputy Commissioner.

The A. S. M. I. St. Louis Convention

It was our intention to give in this issue the conclusion of our description of the St. Louis convention of the American Society for Municipal Improvements, but this is prevented by the loss of the manuscript by the printer. We hope to give it next week instead. Below we reproduce a photograph of the exhibits at the convention. The arrangement and decoration were unusually effective.

EXHIBIT HALL OF THE A. S. M. I. CONVENTION IN PLANTERS HOTEL, ST. LOUIS

Hoisting and Conveying System For Heavy Trench Work

Equipment installed for handling large amount of heavy materials for deep open excavation and subway construction

The construction of the Interborough Subway System in Manhattan, Brooklyn and Queens Boroughs presented many diverse problems of engineering and permitted the adaptation of various types of construction plant to offset the diminished and high-priced labor supply which confronted contractors during the war.

That portion of the subway system known as the Eastern District Section in Metropolitan and Bushwick avenues, Brooklyn, was constructed by a company formed of a combination of the Mason & Hanger and MacArthur Bros. firms. Edgar A. Groves, chief engineer of Mason & Hanger Co., was in charge of the work and plant layout.

This section of the subway joined the eastern portal of the 14th street tunnel under the East river and consisted principally of cut and cover work, involving an average excavation of approximately 50 feet. It was necessary to excavate the soil, remove it to the waterfront by trucks and handle concrete, steel and other materials.

A system of overhead lateral conveyors was devised and installed over the work, dismantled and re-erected as the work progressed. This system was a ramification of the suspension cableway plant of which the S. Flory Mfg. Co. was the pioneer builder and which it has installed on many prominent engineering projects, such as the Kensico dam and Gilboa dam of the Catskill aqueduct, New York State barge canal, etc.

These conveyors were made of yellow pine timbers supporting a central I beam track, on which a trolley carriage traveled, the conveying rope being attached to each end of carriage. Two sheaves were placed in the lower portion of the carriage for handling the hoisting line and fall block with hook. End-dump buckets were used to handle excavating materials from the cut to the trucks and concrete from the mixers to the job.

Each of the four plants was operated by a 50 h. p. Flory double tandem friction drum electric hoist with friction and brake levers arranged in a battery alongside of controller. The hoists were geared for a traversing speed of 300 feet per minute, hoisting on a two-part line at 150 feet per minute. The conveyors were from 200 to 300 feet long and handled loads up to 5 tons.

The plants were operated continuously for four years, at times for 24 hours a day. The cost of repairs on the four hoists for the entire period did not exceed $200 and the contractors state that the machines were in first-class condition at the completion of the work.

Movable Construction Trolley Line

About 300 trains per day, each made up with ten 16-yard and 20-yard side-dump cars, delivered 24,000 yards of earth and rock spoil to a 245-acre dump yard that was being filled in to a maximum depth of 60 feet with part of the 15,000,000 yards of excavation from the Queenstown-Chippewa power canal near Niagara Falls.

The spoil was hauled about two miles from the center points of the canal by 50-ton electric locomotives on standard gage, well-ballasted double tracks that were shifted transversely to allow the bank to be built out. The locomotives were operated by a trolley line supported on horizontal cantilever beams that projected 7 feet beyond the faces of the A-shape towers to give clearance for excavating machines between the latter and the track.

In order to conform to the varying positions of the track, the towers were each mounted on four flanged wheels that ran on short sections of light track which were taken up in the rear and laid down in advance as required.

Grooved Spikes

Grip spikes 6 inches long under the head and ⅝ inch in diameter with longitudinal grooves making four slightly twisted wings extending nearly full length, have been tested at Columbia University together with plain spikes and screw spikes driven into solid wood and also into ½-inch holes.

Compared with a cut spike driven into solid wood as 100 per cent, cut spikes in a hole develop 93.1 per cent, grip spikes 129.3 without holes and 122.7 with holes, and screw spikes with holes 172.9. Various woods were tested and maximum result was for a screw spike driven in a hole in white oak timber that developed a holding power of 15,560 pounds. The next best result was with grip spikes in a hole in white oak timber developing 11,800 pounds against 10,300 pounds in the same timber without a hole. The cut spikes driven in the same timber with a hole developed 8,700 pounds and without a hole 9,020 pounds. The poorest result was for a cut spike in a hole in Douglas fir developing 3,539 pounds.

Additional experiments made by driving the spike, pulling it ¼ inch and then repeating the operation twice so as to approach the condition of track spikes that worked loose and are re-driven, showed that the grip spike was 29 per cent more efficient than the cut spike and that the screw spike was 78 per cent better than the cut spike in chestnut ties.

Deep Foundation Sheeting Eliminated

The excavation for a land pier of the seven-span highway arch bridge over the Miami river at Hamilton, Ohio, has been satisfactorily accomplished by a dragline machine without requiring the driving and pulling of steel sheet piles and the hand excavation and direct hoisting of materials often involved in work of this nature. The 28 x 62-foot concrete pier has a footing of 150 wooden foundation piles, cut off 26 feet below water level in the adjacent river. The soil consists of 10 feet of river gravel and 4 to 8 feet of clay overlying the stratum of cemented gravel at the bottom of the excavation.

As there was plenty of available room and no adjacent structures to be endangered, no attempt was made to retain the sides of the excavation, and the material was removed by a class 14 Bucyrus machine with a 60-foot boom and a 1½-yard bucket working under water that dug the pit with the required bottom dimensions and with side slopes of about 1 on 2. Although this involved three or four times as much excavation as would be required for a sheeted pit, the total cost was less and the work was more satisfactory than it was estimated would be the case with sheeting and clamshell or hand digging.

After the excavation had been completed, the water was pumped out for a fortunate rise in the river at about the same time brought down so much sediment that the flow through the upper stratum caused it to silt up rapidly and the seepage into the pit was soon diminished 50 per cent. No difficulty was encountered in keeping the pits dry while the foundation piles were driven and cut off, forms erected, and the pier concreted.

Pay on Georgia Highway Work

The County Board of Roads sitting at Rome, Ga., has adopted a resolution providing that labor on road work be paid $2 a day and $5 be paid for a team and driver.

Virginia Appoints Board of Examiners

The governor has made the following appointments to the Virginia State board for the examination and certification of architects, professional engineers and land surveyors: P. M. Winfree, engineer, Lynchburg; James F. MacTier, engineer, Roanoke; John Kevan Peebles, architect, Norfolk; Fiske Kimball, architect, University of Virginia; W. C. Noland, architect, Richmond; Thomas M. Fendall, surveyor, Leesburg; L. B. Dutrow, surveyor, Petersburg; W. D. Tyler, engineer, Dante; C. G. Massie, Amherst. At the organization meeting, held September 17, Mr. Kimball was elected president and Mr. Dutrow, secretary pro tem.

Licensing Engineers in North Carolina

The North Carolina Society of Engineers is advocating the licensing of engineers and surveyors by the state and is drafting a law to be presented to the 1921 session of the legislature providing for a board of examiners to issue licenses to those found qualified. It is proposed to include all forms of engineering, civil, mechanical, electrical, mining and others, and also architecture. It is not intended that it shall conflict with the state laws licensing architects and public accountants.

One of the strong arguments advanced by the engineers for this law is that similar laws already exist in eleven states as to engineers and eighteen states as to architects; and if this number should increase, as seems possible, incompetent engineers who are not able to obtain licenses in other states will naturally concentrate in the states where such licenses are not required.

Labor Notes

Inquiries made by the Industrial Bureau of the Merchants' Association show that in New York City factories there is a slight surplus of unskilled male labor and a marked deficiency of female labor of the same class. It is reported that common laborers are more abundant than at any time since pre-war days, and that whereas a few months ago only half the number required could be secured for given jobs, now all can be obtained easily.

This condition is considered partly due to the extreme high prices, which have caused the discharge of many male workers. The shortage of female workers is attributed partly to the shortage of immigration, to the prejudice against factory work, and largely to the fact that the high wages paid to men make it unnecessary for women to work.

The exodus of Jews from Poland has been increasing so steadily for weeks that the Polish Army Office predicts that it will soon number more than 250,000, of whom most are bound for America.

A French officer attached to the French Military Commission in Poland stated that his government has adopted a policy of expediting the departure from France of a large number of Jews going to America.

Information received by the Immigration Department indicated that as soon as peace is officially declared between the United States and Germany hundreds of thousands of German immigrants will attempt to come to this country in the steerages of all New York bound steamers.

In discussing the labor and wage situation, the "Industrial News Survey," published by the National Industrial Conference Board, says:

"Although no general tendency toward lower wages has yet appeared, there is a noticeable trend of sentiment that recessions cannot long be delayed.

"Railroads, at several important terminal points, announce reductions in their working force, and the men released constitute a measurable increase of labor supply.

"On the whole, however, unemployment is comparatively light, and the expectation of lower wages that is voiced here and there, comes from a belief that the peak has been passed in the cost of living and in speculative profits, and that the lower range of profits will not permit, nor the lower costs of living necessitate, the present high scale of wages generally.

"Steady improvement in efficiency of labor is reported in Mahoning Valley steel industries; some plants," the report says, "are operating with 20 per cent less men than during the war, and have reached a pre-war rate of production. Foreign-born workers, who went to Europe during the steel strike and who are returning, show," says the statement, "a decidedly new interest in their work."

The Employers' Association of Detroit, Mich., reports that during the week ended October 5th there were 10,108 workers laid off in the factories of that city and 953 added; leaving a net decrease of 9,155 for the week. Present working force of shops included in report is 166,953, a decrease since April 1, 1920, of about 16 per cent.

Out of a class of 25 aliens, 22 were recently graduated in Elizabeth, N. J., and presented with diplomas in the citizenship course conducted by the Sons of the American Revolution under the auspices of the Young Men's Christian Association.

The Japanese Question

Dislike and distrust of Japanese immigrants is becoming stronger and stronger on the Pacific coast, especially in California, where violent objection is being made not only to the arrival of more Japanese immigrants but to privileges that have been accorded to those already here. A referendum will be held this fall to determine whether legislation shall be enacted preventing the acquisition of land by purchase by Japanese. This is said to be very offensive to Japan and even assumed by some to endanger diplomatic relations between America and Japan. It is charged that the Japanese wilfully depreciate value of the land on which they are employed or hold leases, so as to purchase it below value, thus driving out American owners and operators and dishonestly acquiring their property.

The prohibition of Japanese immigration is strongly urged and has been taken up to some extent throughout the other states of the Union, from nearly all of which there have come an unusually large amount of notices on this subject, the majority of which are opposed to the Japanese. This is, of course, largely through sympathy with the Californians and through the efforts of the labor organizations, who are opposed to Japanese and all other immigrants who may tend to break their monopoly and bring wages down to a normal level.

Japanese statesmen have proposed the appointment of a commission to come to America and confer with the Federal authorities but doubt is expressed whether the latter will accept this proposition. It is admitted by the Japanese that the exclusion of immigrants and prohibition of alien's land ownership is entirely legal and does, indeed, correspond with measures that the Japanese have already taken with respect to citizens of foreign nations, including the United States.

Paving Mixer Delivers 440 Four-bag Batches in 9½ Hours

Record made laying 779 lineal feet of 16-foot by 8-inch concrete pavement in one shift with 32 men.

A new world's record was established by Alan Jay Parrish, the prominent Illinois highway contractor, on June 30, 1920, when, with a 21-E Smith Simplex Paving Mixer, he laid 744 lineal feet of concrete road, 16 feet wide, 8 inches thick, on a million and a half dollar contract near Paris, Ill.

This remarkable run was made in 9½ hours, using a four bag batch and allowing a full minute mix on each batch The average time, throughout the entire day, for mixing and placing each batch, was just 75 seconds. The complete cycle of mixing operation ran from 70 to 72 seconds. Considering the fact that a full minute of mixing was required, this allowed 10 to 12 seconds for the loading and placing operation—the speediest average ever recorded on a complete day's run.

On August 6th, 1920, Mr. Parrish broke this record by laying 779 feet on that day, after having averaged considerably over 600 feet per day for more than a week.

SYNCHRONIZED OPERATIONS

The operations of the big paver were so synchronized that the discharging time and the skip-raising time were perfectly balanced. When the operator pulled the discharge lever, he also engaged the skip-raising lever. Thus the drum was completely emptied by the time the loaded skip, fully raised, began to reload the drum for the next mix. Not a moment was wasted. A second after the mixed batch was discharged, the material for the next batch was sliding into the drum of the paver.

In loading the skip with the aggregate from the "turn-over" batch boxes, the time-agreement in the movements of the skip and the derrick helped materially in avoiding unnecessary loss of any seconds. The movements of the derrick with which this paver is equipped are controlled by the movements of the skip. The derrick cable works over a drum on the skip-hoisting so that, as the loaded skip is raised, the derrick-hooks lower. When the skip is completely raised the derrick-hooks are fastened to the loaded batch box; then, as the skip lowers, the derrick cable rises, lifting the loaded batch box to just the proper height by the time the skip has reached the ground.

Two men swing the batch box into position and dump its contents into the skip. Then the skip is raised and the derrick-hooks lower away the empty batch box to its car on the industrial train. During the minute of mixing, there is ample time to spot the batch box cars in position for the derrick to grab the next loaded box.

STORING AND HANDLING MATERIALS

The installation of all the plant and handling of materials were all carefully arranged for speed.

The yards are located about a mile from the road under construction. The sand and stone are unloaded from the cars by a one-half yard, full revolving Erie Crane, operating on a track parallel to the unloading siding. The crane deposits the material in piles alongside the 24 inch Industrial Railway loading track and also fills the storage bins.

The industrial cars, each with two batch boxes, start at the loading bins, where the proper proportion of sand and stone is loaded. The train then moves by gravity to the cement loading platform, where the cement is added to each batch box. Plymouth 3-ton locomotives then haul the trains to the paver. After the trains once start through the loading process they travel continuously toward the job.

Each locomotive handles ten cars, carrying twenty batches. At no time during the day was there any delay in waiting for the next train to pull into position. A train was always ready on the siding. During the 9½ hours that the paver ran, 22 train loads carried 440 four-bag 1:2:3½ batches.

GRADE, TRACK AND FORMS

An important detail that was dealt with in a particularly careful manner was the method in which Parrish prepared the grade for his Industrial Railway system. He has found from experience that a carelessly formed grade may eventually cause expensive trouble through derailments and delays. So this grade was built up properly and so thoroughly drained before any steel was placed upon it that, in laying over a mile and a half, so far, on this contract, there have been only two minor derailments.

The placing of the railway sidings was planned so that it would be always possible to have the train load of batch boxes at the paver just when the material was needed.

After completing a mile and a half of the pavement, the paver was moved back to the starting point and reversed, to work in the opposite direction, thus reducing the length of the haul from the original loading station. The track was left on the same side of the road, the only change required being to move the derrick to the other side of the paver.

The latest models of Heltzel Steel Forms were used and the tamping and finishing was handled by the new Parrish Tamping Machine.

28 WORKINGMEN

The crew consisted of: 2 crane men, 4 men loading batch boxes—stone, sand and cement, 4 train men, 8 grading crew men, 2 men ahead of paver, handling batch boxes, 1 engineer, 1 fireman, 3 men spreading concrete behind machine, 1 tamping machine operator, 2 men spading and edging, 1 superintendent, 2 foremen, 1 waterboy —total 32 men.

Mr. Parrish states that by using a five-bag instead of a four-bag batch with this paver, he expects to increase the record considerably.

Prices of Materials of Construction

Market conditions and available supply of timber, steel, cement and masonry materials. Written for the October 2nd issue of "Public Works" but omitted for lack of space.

Except for excavating, grading and a few cases of tunneling, construction operations always require considerable amounts of standard manufactured materials, the scarcity, high price, or uncertain delivery of which have, for the last few years, greatly impeded and discouraged construction in many parts of the United States. The great importance of labor economy and efficiency is inseparable from the provision of materials necessary for the execution of the work. The present conditions and recent developments affecting the cost and availability of the most universally used construction materials are, therefore, outlined here in connection with the review of labor conditions and prospects.

The most indispensable materials for all kinds of exterior construction are wood, steel, cement, sand and stone. All of them (except sometimes sand and gravel, which, at least, require labor and equipment for production) are subject to manufacturing process before being used in construction. Besides being subject to increased costs due to war emergency and accompanying economic conditions of the last five years, all these materials have been made more expensive, some of them to an unheard-of degree, by sudden great demands for emergency work for the army and navy and by the increasing wages of the labor required for their production, which has been maintained and increased long after the end of the war. In addition, the market was greatly upset by the priority orders and the discrimination against construction work classified as non-essential, which operated to discourage business and interfered with stocks; while deliveries have long been demoralized and delayed even to the point of complete failure by the congested and inadequate transportation.

These reasons have occasioned a temporary state of insufficient and uncertain supply with exorbitant prices. Improvement has, however, been established and is progressing so that contractors will be able to estimate safely on reduced cost and reliable supplies, which condition will probably improve steadily and greatly promote important construction, for which the necessary labor will be available with better and better quality and amount.

TIMBER

Since the beginning of the war, the timber supply has suffered perhaps more than any of the other construction elements, not only because it alone is, under normal conditions, a rapidly vanishing product which has steadily advanced in price, but also because of the longer and longer hauls required to deliver it to the consumer; its universal application and easy adaptability to almost all construction purposes and many other uses; and the fact that it was used in vast quantities for shipbuilding and other emergency work which, under normal conditions, would have used other materials.

The forest depletion has reduced the area of forest lands in the United States from about 822,000,000 to 463,000,000 acres, exclusive of low-grade woodland and scrub. Of the remaining forest area, only about 30 per cent, or 137,000,000 acres, is virgin forest, the remainder being second-growth timber or territory not restocking. The total volume of standing timber in the country, including both saw timber and cord wood, is estimated at about 745,000,000,000 cubic feet, of which more than one-third is cord wood. The per capita lumber consumption of the United States increased from 230 board feet in 1900 to a maximum of 516 feet in 1906, decreasing to 430 feet in 1913 and 300 feet in 1918, when the total cut was 32 billion feet.

Considering the average annual cut as 40 billion feet, it is estimated that 28 billion feet are used for general building and construction purposes, the remainder being used for railroad ties, manufacturing, etc.

From 1914 to March, 1920, average mill prices in the South and West increased 300 per cent and over, while the average retail prices increased from 150 to 200 per cent in the Middle West, and from 200 to 250 per cent in the East. These prices bear no close relation to the cost of production and distribution, although the cost of production has doubled since 1916.

The total annual growth is estimated at about 1,660,000,000 cubic feet. The amount of yellow pine cut is about three times the annual growth and it is estimated by authorities that in 1930 the production of yellow pine wil be reduced nearly 6 billion feet, namely to about 9 billion feet, equivalent to a yearly decrease of more than 3½ per cent in this timber alone.

In order to insure a permanent and adequate timber supply the United States Forest Service recommends prevention of forest fires and extension of national forests, which, it is believed, can be made adequate for future needs.

It may, therefore, be anticipated that while timber supply will be more reliable and prices will be reduced with a general approach to normal commercial conditions, prices will remain high and economy of timber and substitution of other construction materials will be necessary.

In 1918 the total production of lumber was 29,362,020,000 board feet, a reduction of 11.5 per cent from 1917.

The report of the Southern Pine Association for July, 1920, showed that on July 1, 1920, the stock on hand in 200 mills in this district amounted to 1,221,880,035 feet, which was 40.60 per cent greater than one year previously, and that production during the month of July was 75.58 per cent and the orders 80.33 per cent of normal.

In March, 1920, quotations for 12x12-inch timber in New York, Chicago and St. Louis were, respectively, $71, $75 and $60. In September, 1920, the corresponding quotations were $65, $72, and $57.50.

STRUCTURAL STEEL

The supply of steel, depending primarily on the practically inexhaustible ore deposits, is a more direct function of labor and demand, and while the supply for several years has been adequate for all requirements and the actual cost has been reduced by improved methods and equipment and large-scale manufacture, the price remained fairly constant until the war conditions, operating as in other great commodities, increased labor cost of production, made heavy demands for emergency work and deranged regular markets so that prices were gradually increased; but they have been materially reduced since the close of the war, notwithstanding the heavy loss and reduction of product caused by the recent unsuccessful steel strike. Shipments have, of course, been greatly delayed and at times even prohibited by priority orders and the present inadequate transportation, but there is no doubt that the supply will be ample, deliveries reliable and prices proportionate to general conditions for future business.

Market quotations for March, 1920, were, for beams, channels and angles, $2.45, and for plates $2.65, at mills in Pittsburgh; $3.97 and $4.17 in New York; $4.04 and $4.24 in St. Louis; $3.97 and $4.17 in Chicago; and $5.40 and $6.30 in San Francisco. Concrete reinforcement steel from $2.35 to $2.85 at Pittsburgh mills. In September, 1920, the corresponding quotations were: beams, channels and angles, $2.45, plates, $2.65 at Pittsburgh mills; $4.58 and $4.78, New York; $4.04 and $4.24 in St. Louis; $3.97 and $4.17 in Chicago; and $6 and $6.60 in San Francisco. Concrete reinforcement steel from $2.35 to $2.85 at Pittsburgh mills.

PORTLAND CEMENT

Portland cement is manufactured from stone and clay in about one hundred different localities in the United States, chiefly located in the Mississippi valley, Lake region and the Middle Atlantic states. The amount produced annually has increased from 42,000 barrels, valued at $126,000, in 1880, to 88,230,170 barrels, valued at $81,789,368 in 1914, with a total product since 1870 of 770,518,231 barrels, valued at $736,588,922.

On account of the imports and exports, the total quantity consumed in the United States varies from the production and in 1914 was computed to be 84,418,665 barrels, at a price ranging from 71.07 cents in the Kentucky and southern Indiana district to $1.352 in Utah. The average price per barrel at the mills was $0.92, representing a decrease of $0.078 from the average of 1913. During 1915 there was no violent change in the cement market, the average price falling to 86 cents and the consumption being 0.83 barrels per capita compared with 0.77 barrels in 1914. The production was about 66 per cent of the manufacturing capacity. In 1916 production was 68 per cent of the capacity and the average price rose to $1.103 at the mills and the consumption per capita was 0.89 barrels.

In 1917 the production rose to the unprecedented amount of 93,000,000 barrels, although it reached only 68 per cent of the increased manufacturing capacity. The consumption per capita was 0.84 barrels and the average price was $1.354.

In 1918, although the Government requisitioned about 11,000,000 barrels, the commercial demand was so much reduced that the production was only 70,915,508 barrels, at an average price of $1.596, and a per capita consumption of 0.64 barrels, utilizing only 51 per cent of the total manufacturing capacity. During the five years of the war the average annual production was nearly 86,000,000 barrels, which was greater than that of any year previous to 1913, but was far short of the manufacturing capacity of 130,000,000 barrels, and there was a great fluctuation of prices which varied from 59 per cent below to 110 per cent above the price in 1913. The total estimated production of Portland cement in 1919 was about 80,287,000 barrels and the average price per barrell at the factory $1.69.

In March, 1920, Portland cement was quoted at $2.80, $2, $2.20 and $2.63 in New York, Chicago, St. Louis and San Francisco, respectively, and in September, 1920, it was quoted at $4.22, $2.15, $2.85 and $2.88 per barrel in the same cities.

It is evident that, with the ample manufacturing capacity and the great steady regular consumption, there will be an abundant supply of Portland cement and the prices may be expected to be consistent with the cost of production and reduced to correspond with the gradually modified cost of labor and transportation. One of the greatest difficulties with cement has been the impossibility of securing satisfactory deliveries on account of the discrimination against it on priority orders and the universal deficiency and congestion of railroad transportation. With improved railroad conditions, these difficulties will be diminished and constructions in 1921 should not be much delayed or restricted on account of cement.

CONCRETE AND MASONRY SUPPLIES

Cut stone, broken stone, brick, sand and gravel are widely distributed and involve comparatively little mechanical plant for their production. The principal elements of cost are, therefore, labor and transportation, and with the improvement in these lines, delivery will be more rapid and reliable and prices will be lower.

For a large amount of important construction, especially such as dams and reservoirs, manufacturing and transportation costs can be eliminated by the use of pit sand and gravel excavated near the sites, and this feature, of course, obtains with many road-building operations.

The market quotations for March, 1920, gave the following prices for sand and gravel, and for crushed stone: $2.25 and $1.85, New York; $2 and $2, Chicago; $1.75 and $1.65, St. Louis; $1.50 and $1.50, San Francisco. Brick, per thousand, $25, New York; $14, Chicago; $16, St. Louis; $15, San Francisco. For September, 1920, the prices were: Sand and gravel, $3; crushed stone, $1.90 in New York; $2.15 and $2.35 in Chicago; $1.50 and $1.90 in St. Louis; $1.50 and $1.50 in San Francisco. Brick, per thousand, $30.75 in New York; $16 in Chicago; $16 in St. Louis; $18 in San Francisco.

New York-New Jersey Vehicular Tunnel

Impressive ceremonies attended the official breaking of ground, October 12, at Canal and West streets, New York, for the vehicular tunnel to connect Manhattan Borough with Jersey City.

This tunnel, which has been the subject of long controversy and dissension as to its dimensions and capacity, will probably cost $30,000,000 or more, which is to be equally borne by New York and New Jersey. The design and supervision are in charge of chief engineer C. M. Holland and a board of consulting engineers, Colonel W. J. Wilburs, chairman. The contract for this work was awarded to Holbrook, Cabot & Rollins, New York and Boston.

The first work will be rectangular shafts, in the bottom of which excavating shields will be assembled and the actual driving of the tunnel commenced.

Contract number 1 for the tunnel construction was awarded to T. B. Bryson, New York, for $650,802.50 in competition with four other bids, the highest of which was $1,204,220. This contract is for the construction of two 47 x 42-foot 4-inch steel and concrete shafts 55 feet 4 inches in extreme depth, and some auxiliary work. The shafts are essentially duplicates with concrete walls 5 feet thick with steel plates on inner and outer surfaces and are stiffened by horizontal steel girders. They are to be sunk under pneumatic pressure applied in working chambers 7 feet high, built integral with the walls.

The bid was awarded on unit prices for fifty-eight items, including estimated quantities of 11,410 yards of earth and rock excavation at prices varying from $6 to $8 above water level and $20 per yard below water level; 4,205 yards of concrete at $15 to $21 per yard; 1,120 barrels of Portland cement in grout at $4.50 to $5.75 per barrel; 1,190 tons of steel in the caisson at $282 per ton, and $22,000 for building and equipping an engineer's field office.

Proposed Lake Erie-Ohio Barge Canal

A board of army engineers is now making preliminary investigations of the proposed Lake Erie-Ohio river barge canal that is indorsed by the Inland Waterways Association.

So far four distinct routes have been suggested, namely, from Ashtabula to Pittsburgh, from Cleveland by way of Akron to Marietta, from Toledo by way of Dayton to Cincinnati, and from Sandusky by way of Columbus to Portsmouth. The last is called the Great Central Route and asserted to serve the largest number of people and the wealthiest country, provide the most direct route and reach the coal fields of West Virginia, Southern Ohio and Kentucky.

A bill has been prepared to authorize preliminary surveys of the four routes and provide for funds to be raised by taxation in an area 25 miles wide on each side of the canal and 60 miles wide at the terminals.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

Low Cofferdams on Hard Bottom

Culverts and highway bridge piers are among the structures most frequently required to be built in shallow water where the bottom may be solid rock, boulders, or any hard stratum with either a smooth or an irregular surface.

If the water is not swift or exposed to waves, and if the bottom is not very irregular or subject to an upward flow of water cofferdams can generally be constructed, unwatered, and maintained by the use of ordinary materials and methods but at a cost and time generally greater than required for a hard earth or sand bottom.

The principal difficulties encountered are likely to be in securing stability of the cofferdam, in sealing the joint between the cofferdam and the bottom, and in preventing the upward flow of water through the bottom inside the cofferdam.

COFFERDAMS ON SMOOTH ROCK

If the depth of water is only 1 or 2 feet, an efficient cofferdam may be constructed of a wall of sand bags two or three times as thick at the base as it is at the top, and covered on the outer face with earth or clay or a mixture of clay and sand.

If the cofferdam is for important service or a long period, it may sometimes be advantageous to substitute burlap bags of concrete for the sand bags. If such a wall is properly built, the concrete will exude through the meshes of the burlap and firmly cement the bags together, making, when the concrete is set, a solid, well-bound wall. The bags should be filled not quite full of concrete so that they will adjust themselves readily to each other, pack close together, and fill the irregularities in the surface of the rock.

CRIB COFFERDAMS

For water more than 2 feet deep the most ordinary type of cofferdam on a rock bottom is made of bottomless wooden cribs constructed in position or floated to place, sunk to bearing on the bottom, filled with stone or sand, and made tight by an embankment on the exterior.

The cribs, which are to give stability to the structure and retain loose materials, may be made of sawed or round timber and as they are not themselves expected to be water tight, are constructed in the most rapid and economical manner, often being laid up cob-house fashion with open spaces between the successive courses of timbers, which are crossed at the corners. Pockets are provided in them to contain sand or stone by which they are sunk to position, end to end, as closely together as possible. Afterwards they are filled with stone or earth or both, and a bank of clay or other material as impervious as possible is made on the outside, covering the adjacent surface of the rock and the face of the cribs, and is maintained in position by the cribs. If subject to erosion, the sloping surface of the bank should be riprapped.

Sometimes vertical planks, close together, are placed on the outside faces of the cribs, driven down to hard contact with the rock and nailed in position, thus closing the larger openings between the bottom and the cribs, and making the cribs form of themselves an approximately water tight wall. If these planks extend above water level, and if they have tongue and groove joints they may exclude a large part of the water. Obviously a second row of similar planks may be placed on the inner face of the cribs and will then still further reduce the flow of water, although in this case the pressure of the water tends to push the planks away from the cribs, instead of holding them more firmly against the cribs, as on the outside.

If the lower ends of the vertical planks are beveled to a knife-edge and the planks driven down hard with heavy mauls they will broom up against the rocks and make a closer joint with the irregular surface.

If the surface of the rock is covered with a few inches or more of mud, clay or sand, the planks should be driven through it to the surface of the rock.

BAD BOTTOM

If the surface of the rock is inclined from the horizontal or if the current is swift, it may be necessary to anchor the cribs to rock by steel dowels, holes for which can be drilled through very shallow water by ordinary jack-hammer drills operated by men wading in the water. If the water is deeper, the drilling will be much more expensive, and will require some system of mounted drills with long steels and the holes may have to be protected by casing pipes.

If the surface of the bottom is very irregular, it should be leveled up as much as possible before the cribs are sunk in position. Some of the high points may be broken off and the low places filled with clay dumped in or with sand or with concrete bags, piled up by men working in shallow water or handled by ropes and poles in a little deeper water. After the cribs have been set, large cavities found under them can be filled by bags carefully worked into position from either side of the crib.

If the bottom is covered with boulders and loose rock it is very difficult to construct a water-tight cofferdam on them, and the bottom should be cleared by drags, scrapers, grapples, and blasting, if necessary, to make as even a surface as possible for the bottoms of the cribs. Careful soundings should be taken and an accurate profile of the bottom made at both the upper and lower edges of the cribs, and the latter should be built to correspond, so as to fit closely when sunk in position.

SPECIAL TREATMENT

Unless the water comes up fast through the bottom inside the cofferdam, the latter can usually be made tight enough to be unwatered by liberal embankments of earthy material on the exterior. In extremely bad cases a double line of cribs can be made and the space between them divided into short sections successively filled with puddled clay.

When serious leaks have occurred between the crib and the rock bottom they have sometimes been overcome by an apron of heavy canvas or equivalent material, nailed to the lower part of the vertical face of the crib and having a strip several feet wide spread out horizontally over the rock bottom and covered with earth or clay to hold it securely down in position and exclude the water.

Very small cofferdams can be made, as for soft bottom work, with complete bottomless, tight-wall boxes of wood or steel, set in position as units. The lower edges should be fitted as closely as possible to the surface of the rock, and they can be provided with canvas aprons covered with earth or clay to seal the joint on smooth bottoms.

In some cases, if the design of the structure and local conditions permit, the foundations may be built in sections so as themselves to form parts of a cofferdam in which the remaining sections can be constructed. This method reduces the amount of surface exposed to water and provides regular and stable support for the temporary sections of the cofferdam.

STOPPING LEAKS

Generally the cofferdam must be unwatered by pumping, and if it leaks badly it may be necessary to maintain the pumping continually to keep the water down. If large quantities of water rise through the bottom, the leaks may sometimes be reduced by driving soft pine wedges into cracks in the rock or by filling them with masses of concrete heavy enough to resist upward pressure. For very important work it may be advisable to drill holes in the rock and force in grout under pressure, as is sometimes done for dam foundations, but this, of course, is a slow, costly and uncertain method. If either grouting or concreting is practiced it should be done when the cofferdam is full of water and the cement allowed to set at least 24 hours before pumping is commenced.

Leaks in the cofferdam can be stopped by patching and puddling. Leaks in the joint between the rock and the bottom of the cofferdam are more difficult and are usually best stopped by dumping earth, clay, manure, etc., around the leak on the outside of the cofferdam.

UNWATERING

Unless the bottom of the cofferdam is between high and low water level on a tidal site where it can be drained through a gate or valve at low tide, or unless there is opportunity to waste the water at a low level nearby, pumping will, of course, be necessary.

For small cofferdams with good bottom, ordinary hand diaphragm pumps are suitable and convenient. If the volume of water is too great for hand work, portable diaphragm pumps driven by gasoline motors may be best. For very heavy or continuous pumping centrifugal pumps of 2-4-inch diameter are very effective and may be driven by gasoline, steam or electricity. Usually it is best for small jobs to use the pumps most easily available and when the duty is heavy several moderate-size pumps are better than one or two very large ones; they are cheaper, more easily transported and installed, can be set to better advantage, are more flexible, can be adapted without waste to varying amount of pumping, and give a reserve for breakdowns, repairs, etc.

If much excavation is to be done inside the cofferdam, the pump suctions should be put in one or more sumps. If any very leaky places are disclosed inside the cofferdam, they should be enclosed by separate interior cofferdams and be provided with independent pumps. If there are serious leaks through or inside of a large cofferdam, it should be sub-divided into smaller cofferdams in which the pumps can be successively concentrated and overcome the leaks singly or in small groups.

If the cofferdam is located above an adjacent waterfall or rapids, or near any lower ground where the water may be discharged, it may occasionally be possible to eliminate pumps and unwater by gravity. This may be done by carrying a discharge pipe through or below the bottom of the cofferdam and carrying its outlet to a place where the water can flow away freely. In this case care must be taken to puddle well around flanges where the pipe pierces the cofferdam or otherwise make a tight joint there.

If there is a deep ravine, low-level sewer or other disposal place available within reasonable distance, it may be possible to unwater the cofferdam through a siphon installed in the sump. This method obviates any trenching and will carry the water to a maximum height of more than 20 feet above the surface of the water in the cofferdam if the siphon pipe is air tight and properly filled. It should have valves at both ends and at the summit. After closing the end valves and opening the summit valve the pipe may be filled with water, then quickly and simultaneously reversing the valves will start siphonage, which will continue as long as the supply and discharge are unobstructed.

This method is not likely to be often available, but when it is, may prove economical for handling a large amount of water continuously.

Recent Legal Decisions

DEFECTIVE PERFORMANCE NO DEFENSE TO PAVING ASSESSMENT—PAVING STREET CAR TRACKS

In a suit by a municipality to foreclose a lien for street paving the general rule of law is held to be well settled that where the work is done the municipality, in the absence of fraud, must be the judge as to whether the contract has been complied with. In Church v. People, 174 Ill. 366, 51 N. E. 747, the court quoted with approval from Judge Cooley on Taxation to the effect that, in general, no defense to an assessment that the contract for work has not been performed according to its terms is allowed. But this doctrine must be confined within the proper limits. It cannot be extended to cover a case in which the authorities, after contracting for one thing, have seen fit to accept something different in its place, for, if this might be done, the statutory restraint upon the action of local authorities in these cases would be of no more force than they should see fit to allow. This the Mississippi Supreme Court considers the true line of demarcation. In such an action it holds, City of Jackson v. Buckley, 85 So. 122, that the contention that the original plans called for paving from curb to curb, whereas the city by proper ordinances changed the plans and eliminated a strip of neutral ground in the centre of the street occupied by a street railway company, presented no legal defense. The failure to pave the space between and near the street car tracks did not affect the city's right to require the abutting owner to pave one-third of the street directly in front of his property.

CONTRACT HELD TO CREATE PARTNERSHIP IN IMPROVEMENT CONSTRUCTION

A Missouri contracting company entered into a contract with a street improvement district in Little Rock, Arkansas, to construct an authorized street improvement. Two copartners doing business under a trade-name as a construction company in Arkansas entered into a contract with the contracting company providing that the construction company would finance the contracting company in the performance of the contract and assist it by furnishing bond to guarantee performance and to advance such sums of money necessary to pay all bills incurred during the progress of the work for labor and materials; and the contracting company agreed to indemnify the construction company against losses in the performance of the contract. The construction company, in consideration of its advances and assumption of obligations was to have all the net profits up to $3,000 and one-third thereof above $9,000. The contracting company proceeded with the construction of the improvement. In an action by a feed company for foodstuffs supplied to the contracting company, it is held, Hayes-Thomas Grain Co. v. A. F. Wilcox Contracting Co., Arkansas Supreme Court, 223 S. W. 357, that the contract between the contracting company and the construction company constituted a partnership. There was complete community of interest between them as to the subject-matter, which was the contract with the improvement district, and the profits to arise therefrom. The construction company, it was true, was to furnish certain equipment for use, but this was merely an incident to the main contract. There was no provision in the contract for the sharing of losses, but that was not necessary to constitute a partnership, for the law imposed such an obligation if a partnership existed. There was in the contract all the elements of a joint enterprise, and one of joint contribution to a common end, and the sharing of profits on specified terms, the elements which make a partnership in law. The copartners in the construction company were therefore held jointly liable as copartners with the contracting company. Conceding that the contract was ultra vires so far as the contracting company was concerned, because it was beyond its power as a corporation to enter into a partnership agreement, the company was held liable because the purchase of the feedstuff was in furtherance of the purposes for which the corporation was created, and the partners of the construction company as individuals could not take advantage of the fact that the contract was beyond the power of the corporation.

REGULARITY OF AWARD OF STREET IMPROVEMENT CONTRACT

A construction company applied for a mandate to compel a superintendent of streets to execute a contract presented to him in accordance with the statute for the improvement of certain streets, which he had refused to sign on the ground that the proceedings were void. The California Improvement Act of 1911, par. 61, as amended in 1915, requires the first specific mention of the amount of street improvement bonds to be included in the warrant. It is held, Federal Const. Co. v. Ryan, 191 Pac. 69, that a general reference to prior proceedings adopting the provisions of the act is sufficient to confer jurisdiction on the city council for the purpose of a resolution awarding a contract to the lowest bidder. The city council has jurisdiction to pass an amended resolution of an award of street work correcting a reference to bonds in the original resolution of intention to order the work. A city council's resolution and notice of award of street improvement work under the statute, reciting respectively that the contract was awarded to a company at prices named in its bid, and that the board of trustees awarded the contract to the lowest regular responsible bidder, the particular company, at the prices named for the work in its bid, were held to be in substantial compliance with the law. The mandate was directed to issue.

CONTRACT FOR CEMENT GOVERNED BY QUANITY REQUIRED

The Federal District Court for the Eastern District of Pennsylvania holds that a contract for the sale and purchase of cement to be used by the buyer exclusively in the construction of a government dry dock was one in which the quantity is determined by the requirements of the buyer, acting in good faith, in the construction of the dock; and in an action by the buyer for breach of contract by failure to deliver, it must allege and prove such requirements. Maryland Dredging & Contracting Co. v. Coplay Cement Mfg. Co., 265 Fed. 842. The court cited the case of Wolff v. Wells, Fargo & Co., 115 Fed. 32, 52 C. C. A. 626, where suit was brought for an alleged breach of contract for the sale of cement to be used in the construction of a certain building. The seller named a price "for what you may require, on about 5,000 barrels, more or less." It was held that the contract was not one to deliver any particular quantity, but to deliver so much as might be required in the construction of the building; the designation of "about 5,000 barrels, more or less," being merely the estimate of the parties as to the quantity which would be required.

CONSTRUCTION CONTRACTOR NOT LIABLE FOR INJURY BY REQUIRED FENCING

The Supreme Court of Colorado holds, McPhail v. Seerie Bros. Const. Co., 191 Pac. 103, that a contractor for the erection of a building who, in compliance with a city ordinance, erected a tight board fence on the streets where the building was under construction, was not liable for injuries to a bicycle rider who fell into an excavation made by a telegraph company located near a place where the street was partially obstructed by the fence; the construction company having a right to construct and maintain the fence.

RELEASE OF SURETY BY NEGLECTING TO RETAIN RESERVE UNDER CONTRACT

In an action on a road contractor's bond to recover the value of certain cement furnished by the county to the contractor, it appeared that the contract not only required the county to retain the reserved 25 per cent and the last payment until the contractor had paid all claims, but it further obligated the county to see that its cement bill was paid from month to month by deducting, if necessary, proper sums from the monthly or final payments. This the county neglected to do. It is held, Lewis County v. Aetna Accident & Liability Co., Washington Supreme Court, 191 Pac. 146, that the county could not recover from the surety for the amount due on the cement, since payment by a county to a contractor of the whole amount due, without deducting amounts due the county for material, which, under the contract, it had the right to do, was the giving up of a security for the debt on which the surety had the right to rely. A county cannot recover on a contractor's bond if it has itself breached the contract in any material respect.

INDEFINITE NOTICES OF INTENTION TO PAVE STREESS

The Oregon Supreme Court holds, Henderson v. City of Sheridan, 191 Pac. 350, that a notice of intention to improve a street in the city of Sheridan "by resurfacing from curb to curb, with a wearing surface of asphaltic pavement, and bringing said surface to the proper grade, crown, thickness and wearing surface," given pursuant to the city charter, was not sufficiently definite to give the city jurisdiction to make the improvement. The notice did not state how thick the wearing surface was to be, or what was to be the proper grade, thickness, crown and wearing surface, so that the abutting owners might estimate the expense they were likely to incur. No preliminary estimate and description is required by the charter, and no technical preliminary estimate is required in any event, but the court is of opinion that there should be something approaching reasonable certainty in the description of the main characteristics of the proposed improvement.

The same court, in Byers v. City of Sheridan, 191 Pac. 351, holds that a notice to improve a street in the city which simply described the improvement as a hard surface pavement 16 feet in width is insufficient to confer jurisdiction. The property owner was entitled to be informed in a general way whether it was in the contemplation of the city to pave with brick, stone, bitulithic, concrete, asphalt or any other material which might be employed under the notice.

RULE THAT VOLUNTARY PAYMENTS NOT RECOVERABLE DOES NOT APPLY TO A MUNICIPALITY

The county of Cayuga filed a claim in the New York Court of Claims against the state to recover money paid to the state as a part of the cost of construction of certain state highways for which, under the construction given by the Court of Appeals to the State Highway Law after the money was paid, the county was not liable, the state not being able lawfully to collect from any town in which the state highways were under construction any amount to meet such construction. In allowing the claim, the Court of Claims holds, Cayuga County v. State, 183 N. Y. Supp. 646, that jurisdiction of the claim was conferred on the court by Laws 1918, c. 657. The defense that the payment was a voluntary one does not apply to a municipality. While it is a well-settled principle of law that, where a voluntary payment is made because the error on the part of the person paying was one of law and not of fact, the person making such voluntary payment cannot recover, this rule has no application to a municipality or other public body. This rule of law is based upon the principle that such a payment is not voluntarily made by the municipality, but by its agent, in excess of his authority, and in defiance of its rights. It is not the act of the municipality itself, but of one who assumes to act for it without authority. This is the law not only in New York, but in many other jurisdictions.

NEWS OF THE SOCIETIES

Nov. 5-6 IOWA SECTION, AMERICAN WATERWORKS ASSOCIATION, Sixth Annual Convention, Iowa City, Iowa. Jack J. Hinman, Secretary-Treasurer State University of Iowa, Iowa City.

Nov. 8-12 LEAGUE OF CALIFORNIA MUNICIPALITIES. Annua lConvention, Chico, Calif. W. J. Locke, Pacific Bldg., San Francisco, Calif.

Nov. 10-12—NATIONAL DRAINAGE CONGRESS. Chicago. Atlanta, Ga.

November 12—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Second Fall meeting, Chicago. Sec., 33 W. 39th St., New York.

Nov. 12—CONFERENCE ON EMPLOYMENT AND EDUCATION, sponsored by the American Assn. of Engineers. Chicago.

Nov. 15-17—CITY MANAGERS, ASSOCIATION. Annual convention at Cincinnati, O. Executive Secretary, Harrison G Otis, 812 Tribune Bldg., New York City.

Nov. 18-19—AMERICAN ENGINEERING COUNCIL. Organization meeting. Washington, D. C.

Dec. 7-10—AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual meeting, New York. Secretary, 29 W 39th St., New York City.

Dec. 9—THE BROOKLYN ENGINEERS' CLUB. Annual Meeting, election of officers.

Jan. 25-27, 1921—THE AMERICAN WOOD PRESERVERS ASSOCIATION. Place of meeting to be announced later.

AMERICAN WATER WORKS ASSOCIATION
IOWA SECTION

At the sixth annual convention of this section which will be held in Iowa City, November 5-6, the following papers will be read: November 5th, "Tropical Water Supplies," by Don M. Griswold, State Epidemiologist, Associate Professor of Hygiene and Preventive Medicine, State University of Iowa; "Further Observations on the Eosine-Methylene-Blue Agar," by Max Lexine, Associate Professor of Bacteriology, Iowa State College, Ames, Ia.; "A Self-Cleansing Underground Water-Collecting System," by George T. Prince, consulting engineer, Omaha, Neb.; "Pumpers, or Triple Combination Chemical Engines," by William Molis, Superintendent of Water Works, Muscatine, Ia.; "Valuations of the Iowa City Water Company, Based on Present and Pre-War Costs," by John H. Dunlap, Professor of Hydraulic and Sanitary Engineering, State University of Iowa; "Popularizing Water," by Robert E. McDonnell, consulting engineer, Kansas City, Mo.; "Progress on the Dayton Flood Control Project," by Sherman M. Woodward, Professor and Head of the Department of Mechanics and Hydraulics, State University of Iowa. November 6th, "The Application of Copper Sulphate to Basin Walls for the Control of Algae," by George F. Gilkinson, chief chemist, Water Department, Kansas City, Mo.; "Value vs. Investment as a Basis for Utility Service Rates," by William G. Raymond, Dean, College of Applied Science, State University of Iowa; "State Provision for Water Supply Control," by Jack J. Hinman, Jr., Assistant Professor of Epidemiology and Water Bacteriologist, State University of Iowa, Water Bacteriologist and Chemist, Iowa State Board of Health.

The papers to be discussed at the "Round Table" are as follows: "Financing Water Main Extensions," "Cleaning Water Mains," "Fire Protection Charges," "Operating and Test Duty of Pumps," "Standardization of Meter Bolts," "Insurance of Pumping Machinery against Breakage," "The Use of Electric Weld Pipe."

INTERNATIONAL ASSOCIATION OF STREET CLEANING OFFICIALS

At the invitation of W. J. Galligan, assistant superintendent of streets of Chicago, 44 street cleaning officials, representing 28 municipalities of the United States and Canada, held a conference in that city on October 7th and 8th, the outcome of which was the forming of the International Association of Street Cleaning Officials. The object of the society is "the acquisition of knowledge relating to the cleaning of streets and the dissemination of this knowledge among the members of this Association with the view of improving the service and reducing the cost, and the establishment and maintenance of the spirit of fraternity among its members."

Members are of four classes—active, associate, honorary, and life. Active membership is limited to superintendents of street cleaning departments in municipalities and towns of the United States and Canada, and "other persons having charge of or connected with municipal street cleaning departments."

Associate members are "manufacturers of and dealers in appliances relating to the interests kindred to the Association."

The officers elected were: President, W. J. Galligan, assistant superintendent of streets, Chicago, Ill.; vice-president, Theodore Eichhorn, superintendent of streets, Erie, Pa.; secretary, A. M. Anderson, 1340 Old Colony Bldg., Chicago, Ill.; treasurer, Robert W. Waddell, city engineer, Kansas City, Mo.; and a board of governors. The constitution provides that the headquarters of the Association shall be determined by the residence of the secretary.

The subject of street flushing was discussed at length, the majority holding that this method was injurious to the pavements and the cause of many accidents. Colonel Sullivan of Boston spoke of the advantages of granite block pavement from a street cleaning viewpoint; littering of streets and discussion of wages were among the important subjects on the program. The consensus of opinion seemed to be that labor conditions are showing a tendency to improve. The matter of snow removal brought out interesting facts, the majority pronouncing the burning method a failure. Mr. Walsh of Minneapolis told of his success in using an ordinary combination road scarifier and grader, pulled by a tractor with caterpillar traction. The scarifier breaks the ice and the road machine blade moves the snow and ice to the gutters or catch basins. Much damage is caused by allowing the snow to remain too long on asphalt streets.

AMERICAN SOCIETY of MECHANICAL ENGINEERS

The society announces the following officers elected: Edwin S. Carman, president; John L. Harrington, Leon P. Alford, Robert B. Wolf, vice-presidents for two years; Henry M. Norris, Carl C. Thomas, Louis C. Nordmeyer, managers for three years; Major William H. Wiley was reelected treasurer. The secretary will be elected by the society's council at the annual convention which will be held in December in New York City.

The council has announced extensive plans for promoting professional endeavor and public service, particularly as to industrial relations and rewarding engineering achievement. The finance committee recommended a budget of over $500,000 for the ensuing year. The engineering foundation fund for the promotion of engineering research, of which the society is one of the sponsors, will very soon amount to $1,000,000.

John H. Barr of New York, formery professor of machine design at Cornell, has been appointed the society's representative on the National research Council for a term of three years.

The special committee appointed to interpret a declaration contained in a resolution adopted at a general session held December 3, 1919, says: "The central thought in this declaration is that production is the utilization of the forces of productivity, that product comes into being through the action of those forces, that the purpose of industry is to produce goods for the use of mankind and, therefore, it must be conducted from the motive and in the spirit of rendering essential service to society as a whole, which, of course, includes the workers themselves. The committee is at work upon an interpretation of the declaration in regard to credit capital, and intends to present this in the form of a supplementary report."

The meetings and progress committee have detailed plans for the annual convention of the society in New York in December and also announced plans for a congress of mechanical engineers to be held in Chicago next spring.

The society has formed an aeronautic section, the membership including Orville Wright, Howard E. Coffin, Edward A. Deeds, Jesse G. Vincent and Elmer A. Sperry.

THE BROOKLYN ENGINEERS' CLUB

Announcement is made of the following meetings: November 4, "The German Long-Range Gun," by Lt.-Col. H. W. Miller; November 11, "City Planning for the Borough of Queens," by Charles Powell; November 18, "Industrial Brooklyn, Paper No. 2," by Walter Pfaendler; December 2, informal talk by E. C. Wilder.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

CONCRETE CONSTRUCTION DEVICES

The Concrete Devices Corporation has issued a circular descriptive of time and labor saving devices for plain and reinforced concrete construction covering thirty United States patents pending or devices mentioned that have been invented by George F. Newton. These include form clamps, form clamp keys, washers, form ties, form spreaders, bar spacers, bar hangers, corner bar clips, beam saddles, floor chairs and concrete inserts.

The hook spreader system is used mainly for ship construction and for walls under 6 inches thick. Like most of the other devices, it is formed mainly of heavy hard drawn steel wire provided with suitable bearings and adjustments. This device consists essentially of a double hook permanently embedded in the wall that engages the reinforcement bars and is attached to adjustment hooks passing through the forms and provided with exterior wedge bearings.

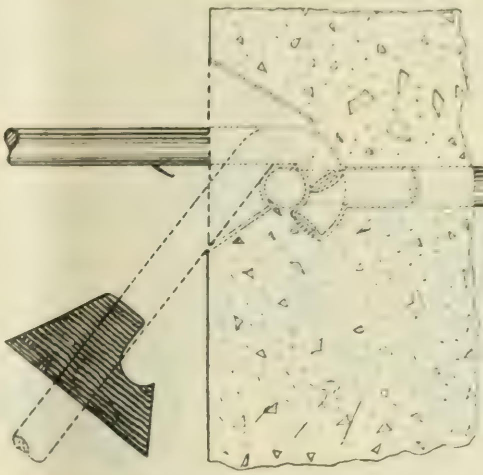
The plain spreader for thicker walls is provided with separate clamps to the reinforcement rod and is adjusted by wedges at both ends which engage a special cast-iron bearing washer which is nailed to the form. One hammer blow on the clamp key tightens and holds the form and steel reinforcement securely. The system costs less than other methods, saves a large amount of time in assembling the reinforcement, avoids cutting steel after forms are removed and eliminates tightening wrenches, set screws, and rod pullers.

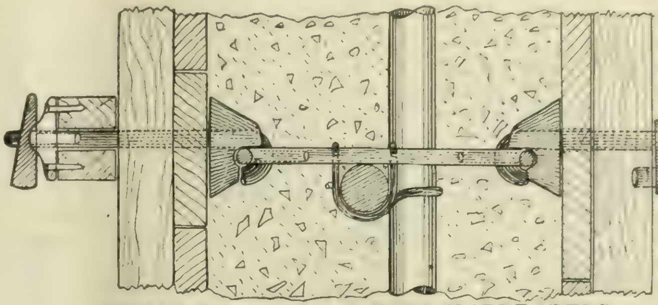
A very important advantage of this spreader is that after the forms are stripped, releasing the exterior form tie and washer the former can easily be slightly moved by hand, destroying adhesion of the concrete to the washer and enabling the latter to be slid out on the tie, clear of the surface of the concrete, and the tie to be unhooked from the permanently enclosed inside spreader.

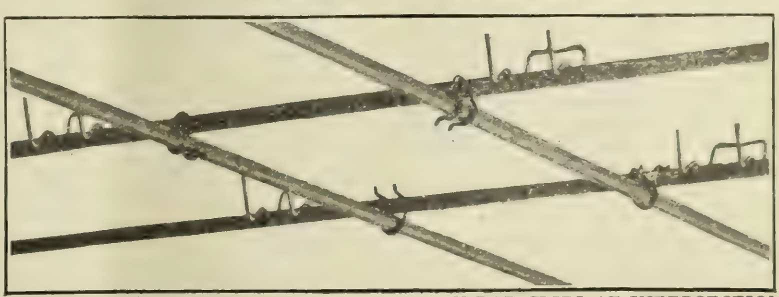
This leaves a small conical hole in the face of the concrete into which the eye of the permanent spreader projects sufficiently to provide efficient anchorage for the mortar with which the hole is subsequently pointed.

One of the most distinctive of the appliances is the bar clip, made of spring wire, and snapped instantly into position at the intersection of two bars of any size or shape, holding them securely in position and not requiring the use of any tools or adjustment.

Form clamps and form ties are bent rods with end hooks engaging adjustment wedges by which they are quickly tightened. The form washers are small castings designed to draw the loop of the form spreader up to the shoulder of the washer and in one operation to prevent sagging or spreading of the form.


REMOVING EXTERIOR TIE AND WASHER


WALL FORM LOCKED BY PLAIN SPREADERS


REINFORCEMENT STEEL HELD IN PLACE BY BAR CLIPS AT INTERSECTIONS.

Bar spacers are wires with U-shaped bends in them, that are snapped over reinforcement rods to hold the latter securely in any required position.

Bar yokes for splicing bars are U-shaped plates perforated to receive a tightening wedge. The plate engages the overlap of the bars and holds them firmly in position by driving the wedge. By its use the overlap of bars may be reduced from 40 to 10 diameters. The bottom of the wedge is concaved to provide two knife edges that cut into the bars, thus holding them still more securely.

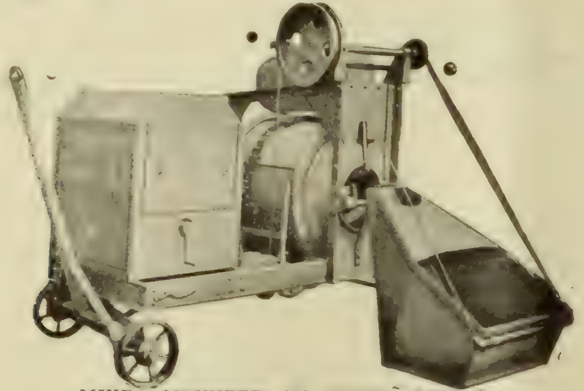
Floor chairs for round or square bars, provide a rigid connection for intersecting bars that may be simply snapped into place without the use of tools, and permanently supports them at the required distance above the bottom of the form, thus eliminating wood or cement blocks. They displace a minimum amount of concrete.

TRUCK SALES INCREASE

Sales of Mack trucks for September represented a 9 per cent increase over August. Comparing this year with last, the company states that September, 1920, showed a 44 per cent increase over September, 1919. Taking the three months' period ending September 30th as a basis, the sales of Mack trucks of capacities from 5 to 7½ tons, increased 55 per cent this year over last year. This indication of the economies offered to shippers by big-unit hauling bears out the general belief that transportation costs can be reduced by encouraging the use of the large capacity truck.

KEYSTONE MIXER

The Keystone mixer, model 10, power loader, manufactured by the Gray Iron Foundry Company, is recommended by them for its excess strength, power and thoroughness of mixing. The over-all dimensions and weight are less than those of any other power loader of full batch capacity on account of its simple construction and few moving parts.



MIXER MOUNTED ON TRUCK, ENGINE ENCLOSED IN STEEL HOUSING

In each pocket mixing wings are arranged to churn and rechurn the mix thoroughly in 1 minute. Free operation of this drum with minimum friction is secured by drum roller bearings of extra length that require oiling only once in two weeks. The extra large dimensions of the charging bucket eliminate trouble and delay in loading; the discharge is governed by a hand wheel and is very rapid and complete. The mixer is provided with a positive gravity water measuring tank that promotes uniformity and improves the quality of the concrete. The bucket is hoisted by an endless cable, the hoist being of the expanding ring type designed for hard service, readily adjustable and operated by a single lever which controls both hoist and brake.

The machine is provided with a sheet steel housing with removable rear and side doors which is complete, compact and easily portable. The drum capacity is 10 cubic feet of loose materials, or 6 2-3 cubic feet of mixed concrete per batch. The machine is driven by a 6-h. p. vertical gasoline engine with a speed of 475 revolutions and a drum speed of 21 revolutions per minute. The weight, complete, is 3,600 pounds.

PERSONALS

Whitecarver, O. W., has been appointed assistant U. S. district engineer at Charleston, S. C.

Painter, Capt. P. C., has been appointed city engineer of Washington, N. C., and will take charge of important paving, sewerage and waterworks construction next spring.

Stewart, Major J. W., Corps of Engineers, U. S. A., has been retired for physical disability.

Cooley, Mortimer E., dean of the College of Engineering and Architecture, University of Michigan, has been made a member of the Postal Advisory Committee.

Walker, L. C., has been appointed to the U. S. Reclamation Service and assigned to survey for the American Falls Reservoir, Idaho.

Edwards, J. T., has been appointed supervisor of maintenance in the road department of the New Jersey State Highway Commission.

Anderson, W. H., has been appointed drainage engineer for the St. Louis Southwestern Railway, with headquarters at Dallas.

Snead, C. D., has been appointed bridge engineer of the U. S. Bureau of Public Roads at Montgomery, Ala.

Copp, W. P., has been appointed professor of civil engineering at Dalhousie University, Halifax, N. S.

Dunlap, F. C., has been appointed chief of the Bureau of Street Cleaning, Philadelphia.

McDermott, J. R., has been made assistant division engineer of the West Virginia State Roads Commission.

Bringhurst, J. H., has been appointed assistant engineer in the Bureau of Highways, Philadelphia.

Easler, R. P., has been made manager of the West Coast Dredging Co.

Dyatt, A. E., has been made resident engineer on Federal aid work in Douglas county, Kansas.

Harwood, R. E., civil engineer and road contractor, died recently in Springfield, Ohio.

Meredith, John W., has been appointed city engineer of Antioch, Cal.

Bonar, S. H., has been appointed city engineer of Moundsville, W. Va.

Ridley, C. E., has resigned as city engineer of Port Arthur, Texas.

Willey, N. F., contractor and builder, died at Norwich, N. Y., August 28.

Sheldon, Prof. Samuel, Polytechnic Institute, Brooklyn, died September 5.

Hilgeman, Henry, contractor and builder, of Ft. Wayne, Ind., died recently.

Moyes, W. E., general contractor, died June 21, at Sharpburg, Pa.

Gates, R. M., has been appointed managing engineer of the Philadelphia district of the Lakewood Engineering Co.

Waterhouse, Dr. G. B., has been appointed inspecting and metallurgical engineer of the Lackawanna Steel Co., Buffalo.

Albright, John, has been appointed erecting engineer for the Champion Engineering Co., Kenton, Ohio.

Parin & Marshall have moved their consulting engineer office to 1107 Broadway, New York City.

The J. C. Mack Co., general contractors, have moved their offices to 103 Park avenue, New York City.

The Phrale Construction Co. has been formed and opened offices at 316 Marine Bank Building, Erie, Pa.

McGuire, B. F., general contractor, has opened an office at 500 Fifth avenue, New York City.

H. R. Douglas & Son, general contractors, have opened an office in the Barrows Building, New London, Conn.

Wilmot, E. A., civil engineer, recently died at Victoria, B. C.

Hill, William, contractor, Chatham, Ont., died September 6.

Begg, J. M., has been appointed engineer of waterworks improvement at Brandon, Manitoba.

Shupe, Stanley, has been appointed acting town engineer of Oshawa, Ontario.

The Willite Road Construction Company of New York, Inc., has just started construction of 50,000 square yards of the Hudson County boulevard, Jersey City, which is the Atlantic Tidewater terminal of the Lincoln Highway.

Darcy, H. J., has been appointed state sanitary engineer of Oklahoma.

Hoover, C. B., has been appointed engineer of water works extensions, Columbus, Ohio.

Gray, C., has been appointed chief engineer, Indiana Highway Department.

Wright, L. H., chief engineer of Indiana State Highway Department, has resigned that position.

Connery, Major F. C., civil engineer for the Pearson Engineering Corporation, of New York City, who served with the Canadian Forces in France, died in Toronto, September 18.

Wigmore, R. W., formerly commissioner of water and sewerage for the city of St. John, New Brunswick, has been re-elected to the House of Commons.

Andrews, M. O., general manager of the Unit Construction Company, Fall River, Mass., died August 9.

Rogers, C. G., contractor and builder, Potsdam, N. Y., died August 23.

Parker, J. L., has been appointed senior highway bridge engineer for the South Carolina State Highway Commission.

Davies, J. C., has been appointed testing engineer for the State Highway Department, Oklahoma.

Bruce, J. A., city engineer of Omaha, has resigned to enter the engineering firm of Bruce & Grupe, Omaha.

Miller, W. E., has opened engineering office for steam and electric railway and public utilities work at Madison, Wis.

O'Brien, E. J., & Bro., Inc., engineers and contractors, have opened an office at 299 Division avenue, Brooklyn, N. Y.

Frost, Ford & Westell Construction Co., general contractors, have opened general contracting offices at 400 Penobscot Building, Detroit.

Dwight P. Robinson & Co., Inc., have opened a new branch office in Youngstown, Ohio, and have moved their Cleveland office to the Citizens' Building.

PUBLIC WORKS.

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 49 FLORAL PARK, NOVEMBER 6, 1920 No. 19

Snow Removal Tests

Removal of snow from city streets is becoming increasingly common and expensive, and the larger cities are finding it a serious problem. The New York Street Cleaning Department, after experimental tests, has ordered 100 tractors and many motor trucks and has invited bids for other tractors, plows and other heavy equipment for next winter's service.

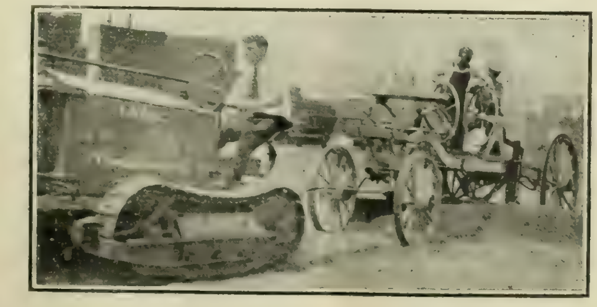
It is estimated that during the month of February, 1920, traffic tie-ups due to unexpected snow-falls cost the merchants of New York City $60,000,000 and the city itself $5,500,000 for emergency snow-removal work. Although the Department of Street Cleaning made strenuous efforts its equipment was inadequate to handle the situation and outside contractors were called in but failed at the critical time.

Horse-drawn snow plows and motor trucks were inefficient in the deep drifts. None of the equipment owned by the department, or available outside, was able to handle the heavy fall of packed snow, except a few small tank-type tractors which had been voluntarily offered for the work.

A snow-removal committee was appointed to report to the mayor on ways and means of handling the snow in the most efficient manner. The chairman, Fire Chief Kenlon, in view of successful fire-fighting experience, decided that it is imperative to have motor equipment which can be kept at work throughout the storms so that it will be necessary to clean up but a small part of the snow when the storm is over.

The Snow-Removal Committee, working on this basis, organized a series of tests that were made last July. All manufacturers of track-laying (caterpillar tractor) tractors were requested to compete in this event.

The tractors taking part in the demonstration were Holt, J. T., Monarch, Bates and Cleveland; all excepting the Bates being of the crawler or track-laying type. The Bates is equipped with crawlers in the rear, with the addition of two wheels in front to guide and for flexibility of operation.



TRACTOR HAULING SNOW PLOW IN REAR

The tests were made on Avenue C, between 18th and 19th streets, on July 29, 1920. Damp sand weighing 90 pounds per cubic foot was spread on the asphalt pavement over an area of 7,500 square feet (125 feet long by 60 feet wide), one-half to a depth of 4 inches and one-half to a depth of 6 inches

The Department of Street Cleaning snow plows with varying lengths of blades set at an angle of 45 degrees, were attached to tractors, which started at the edge of the sand bed and worked into a full width stroke, pushing the plow for the full length of the spreadings.

Equipped as before except with plow set at right angles, the tractors started in at the center of the 6-inch bed of sand in which the three heavy tractors (Holt, J. T. and Monarch) were required to push a full stroke for the entire length of the bed.

Finally, with the front plow raised out of the way and a Climax plow attached to rear end, the two smaller tractors (Bates and Cleveland) were to start at edge of the sand bed and, working into full stroke, plow windrows for the full length of the spreading. All the tractors fulfilled the requirements of the test.

RESULTING SPECIFICATIONS

Based on the results of these tests, specifications were prepared and bids invited by the engineering Bureau of the department for 150 gasoline motor-driven track-laying tractors. Each bidder was required to submit evidence that there are at least 50 of his make of tractors in operation in the United States which have each given not less than one year of service. The engine must be a four-cylinder, four-cycle engine, which will develop not less than 20 brake horse-power at governed speed.

Ignition must be by high-tension magneto with impulse coupling and motor shall be easily started by hand. In lieu of the high-tension magneto, dual ignition with battery and generator may be used. The engine shall be provided with a centrifugal governor which can be set to keep the motor at constant speed. Final drive must be gear, worm or chain.

A committee appointed to purchase snow-removal equipment decided to buy 100 small tank-type tractors, 50 large crawler-type tractors and a big fleet of trucks with dump bodies, together with the necessary push plows for the tractors.

The order for 100 small tank-type tractors has been awarded to the Cleveland Tractor Company, of Cleveland, Ohio, which will supply standard 12-20 Cletracs weighing 3,800 pounds each and equipped with winter tracks, a covered cab, a two-man seat, storm curtains and sirens.

Bids have been received for 50 heavy tractors weighing not less than 8,000 pounds each that must be manufactured by makers established at least eight years and builders of their own engines. Bids have also been received for three wrecking cars equipped with cranes, but contracts for them have not yet been awarded.

For use with the tractors there have been purchased 212 White 5-ton 6-yard automobile trucks with dump bodies, 75 of which are to be equipped with alternate 1,200-gallon flushing tanks for summer use; 100 2-ton Mack auto-trucks; 150 4-wheel and 300 auto-front plows made by the Good Roads Machinery Co.; 4 ¾-ton delivery trucks; and 1 Friedman's mechanical snow loader.

The tractor tests were conducted under the direction of Honorable Frank E. Eschmann, acting commissioner of street cleaning; A. A. Taylor, general superintendent; John Sondon, superintendent of snow removal; and Elmer Clark Goodwin, examining engineer, Department of Street Cleaning.

ENGINEER'S REPORT

A few weeks ago Mr. Goodwin submitted to Grover A. Whalen, commissioner of the Department of Plant and Structures, "full particulars of the purchase of trucks, tractors, plows and other equipment which the city contemplated making, as well as of the plan for co-operation between the street cleaning, fire, police and other city departments; likewise the plans for obtaining labor and hiring privately owned vehicles, with the employment of the contractor's and railroad's forces for the speedy removal of snow from the city's streets during the coming and subsequent winters." His report is as follows:

Organization—The organization for snow work will be divided into three classes:

1. Snow fighting to be composed of the department force and equipment augmented by hired laborers.
2. The contractor's forces for the removal of snow after the storm ceases falling.
3. The railroad's forces, which are the forces under the direction of the railroad companies assigned to the streets which they are obliged to clear of snow under the terms of their contract with the city and their respective franchises.

The general plan for the purchase of the various articles of equipment was set forth in the Snow Committee Report, of which Chief Kenlon was the chairman, and in accordance with such policy we have already awarded a contract for 212 five-ton gasoline trucks to the lowest bidder, the White Company. The specifications of the contract call for the delivery of the first fifty trucks about the first week in December and the balance of 162 trucks to be delivered by January 15, or in an installment of 50 trucks every 20 days after the first delivery.

Plans and specifications have been drawn for the purchase by public letting of:

100 two-ton auto-trucks.
150 four-wheeled plows.
300 auto-front plows.
150 tractors of the caterpillar type (100 known as the small size, not less than 3,800 lbs., and 50 not less than 8,000 lbs.).
3 wrecking cars equipped with cranes.
4 three-quarter-ton delivery trucks (for delivering supplies.)
1 mechanical snow loader (Friedman machine).

Plans and specifications have been prepared for a large garage and receiving station in Brooklyn on Water and Dock streets, with a capacity for sheltering 300 auto-trucks.

Plans are being prepared for a central repair shop and this is to be followed by the building of twenty-two garages throughout the city in the Boroughs of Manhattan, Bronx and Brooklyn, city-owned property which has been turned over to the Department of Street Cleaning for this purpose by the Sinking Fund Commission and the Department of Plant and Structures.

Co-operation of Other City Departments—In the proposed plan of co-operation between the Street Cleaning, Fire and Police Departments, it is intended to assign two policemen or two firemen to operate the caterpillar tractors, who are licensed chauffeurs, skilled in the work of operating motor-driven apparatus, who will command auto and horse-drawn truck drivers to give these tractors the right of way.

The general plan of operating these tractors, together with five-ton auto-trucks of the department, will be as follows:

As soon as a snow-fall starts and the Commissioner is convinced—after consulting with the Weather Bureau Officials—that it will be a continued storm, he will issue orders to have the tractors and trucks begin work. The plows shall be attached to the trucks at the various garages, and the police, fire and street cleaning operators who are assigned to this work shall immediately report for duty and proceed at once to the points where they are to plow.

TRACTOR PUSHING SNOW PLOW IN ADVANCE

The scheme, as outlined, is to have plows in teams of two clean a width of 20 feet of roadway for a distance of three lineal miles in one hour and to continue working over such a route after the snow has ceased falling. The average rate of snow-fall is ½ inch per hour and the motor-driven plows operating at the rate of three miles an hour, will cover the entire area every two hours, constantly plowing 1 in. of snow on each trip up and down the assigned area.

Rapid Snow Removal—With 150 tractors and 250 five-ton trucks operating, all of which will have snow-plows attached, starting at 200 different points and covering 3 lineal miles, cleaning 20 feet of roadway, it will be noted that the department will—with its own equipment—have plowed, at the cessation of snow-fall in each storm, six hundred miles of roadway in the important sections of the city, 70 per cent of which will be in the Borough of Manhattan, so that there will be no interruption of traffic such as practically paralyzed the trucking business last year and incurred the loss of millions of dollars.

This force wll be augmented by the hiring of auto-trucks to which department snow plows will be attached and it is estimated that 100 of these will be engaged working in the same manner as the department trucks and tractors covering an additional 150 miles of roadway. It is intended that this total force will be operating within one hour after the call has been issued by the Commissioner, so that if the storm is in progress one hour and it is decided to call out the force, all the equipment will be in motion within two hours after the storm starts or, in other words, the full force of motor-trucks and tractors will be operating when the snow shall have reached a depth of one inch.

The first point in the work of snow removal is to keep traffic moving. This will be accomplished by throwing the snow from the center to the sides of the roadway. The second point is to have the snow removed as quickly as possible after it is thrown to the sides. For this purpose it is intended to utilize the 100 two-ton department trucks and the department force of carts approximately 500 in number, on the first day of each storm, to haul the snow to the most convenient disposal points, such as sewers and water-front dumps.

During the progress of a storm, the laborers will be assigned to work at the same time that the call is issued for the plows to start out and they will pile the snow just as soon as it is thrown to the side of the roadway by the plows. This will obviate delay as formerly occurred while waiting for the contractor's forces to begin work, which was usually delayed until the following day.

The Street Cleaning Department intends to remove the snow with its own force south of 14th Street, in the Borough of Manhattan, where the greatest difficulty developed last year, and to extend its forces, wherever practicable, north of 14th street on the main thoroughfares, such as 5th Avenue, Broadway and other main arteries of traffic, so that the snow will be removed with all possible speed.

It is purposed to utilize the plows attached to the tractors to push snow from the roadways to the sewer manholes wherever such are available, after they stop plowing, which means that 150 tractors will be pushing snow on all streets where sewers are available and in this way great quantities will be removed quickly.

Emergency Workers—The plans also provide for registration of the emergency men in advance of the winter season in order to have an available snow-fighting force of laborers report at the 103 section stations throughout the three boroughs, at which places they will be equipped with picks, shovels and pan scrapers; and under the direction of squad leaders they will be assigned to certain routes for sewering or piling the snow, depending upon the type of sewer adjacent to the various points at which they are assigned to work.

The rates of pay to attract a sufficient number of laborers for snow-work will be determined later in the year, depending upon what a survey of the labor conditions will indicate. As it is intended to make every effort to have the snow removed quickly, a raise in the rates would seem to be one of the means of inducing laboring men to report promptly in sufficient numbers to get the work done rapidly and at a minimun expense, for it is easier to handle the snow immediately after it has fallen than to permit it to be pressed down by the traffic and hardened by freezing.

Prohibitory Cost of Paving

It is reported that the road commissioner of New Orleans has decided to abandon some of the proposed paving contracts for which the bids received are considered unreasonably high. It is considered preferable to lose a year than to pay $8 per square yard for work which formerly cost $2. A tabulation of the bids showed "entire absence of competition," and although it is not claimed that the prices asked are more than the cost of materials and labor warrant, it is felt that the figures are almost prohibitory and that the burden should not be inflicted at present on the contractor. Under the law the work already bid on must be executed or abandoned because it is required that contracts for paving must be made a year in advance and therefore this work cannot be deferred a few months.

Selecting a Type of Road Surface

A discussion of the question, "What type of surface will give the best results under a set of given conditions?" A tentative solution is proposed by the Office of Public Roads.

The general subject of selecting the type of road surface for any given highway improvement, basing such selection upon some reasons that have definite information as their foundation, was discussed before a conference of district engineers by E. W. James, assistant chief engineer of the Bureau of Public Roads.

Selection of the type of road is, he said, "one of the large and still open questions in highway engineering." Data are lacking for reaching any definite conclusion based entirely upon technical considerations. There is little or no unity of opinion as to the service value of the various types under given conditions of traffic, or regarding the probable length of life of the several types. On the basis of cost over a period of years, opposite conclusions were reached recently by two engineers of one of the large state highway departments. Data simply are not available for a purely technical answer to the question: "What type of surface will give the best results under a set of given conditions?"

Many engineers and investigators, however, are endeavoring to secure such data, chief among these being the Bureau of Public Roads, which is the only governmental organization having at its disposal funds and personnel for conducting the necessary experiments.

Aside from the technical considerations, there are and probably always will be several important administrative ones which will have considerable weight in determining type of pavement. These are the exigencies of construction (involving engineering administration), financial limitations and the influence of local opinon, which opinion is frequently influenced by the promotion work of those having materials, equipment or proprietary types for sale.

The Bureau of Public Roads has for a number of years been collecting data, probably the most valuable of which are in connection with surface treatments. It reports having found, for instance, that a water-gas tar preparation applied as a cold surface treatment, maintained under patrol, will carry 925 gross tons of traffic per day, and under this traffic the maintenance will be in the third of seven experimental sections on the basis of economy; but this same section was destroyed by 1,130 gross tons per day beyond the point of any reasonable maintenance. The average life of a retreatment of this material was found to be eight months. A hot tar surface treatment stood up satisfactorily under 1,325 gross tons daily average.

There are considerable more data of this general nature which are being collected and others which, having been collected, are now being studied and conclusions drawn. As yet, however, there is little or no material of value in the literature of highway engineering or in the engineering press relative to the determination of type. "Engineers have written all around the subject but have generally refrained from committing themselves to figures."

With respect to heavy trucking, the observations of the Bureau of Public Roads are that trucks rated heavier than three tons are generally seriously destructive of any type of pavement customarily used on rural roads up to 1917. Further, the destructiveness varies directly with the speed, but probably in greater ratio. It appears that constant use of a few trucks per day, if they are heavier than three tons and run at a speed of 25 to 35 miles per hour, is sufficient to cause high-type pavements of designs current in 1916 to fail, no matter how well they may be maintained.

During the past two years there has been a continual increase in the practice of submitting alternate designs for projects on which Federal aid is asked. Some states have adopted something like a system in selecting and even in deciding between these alternates. The state of Illinois has attempted to set up a rational method of comparing types, one essential feature of which is that, studied as a beam, a pavement cross-section constructed wholly of concrete is stronger than one with a bituminous top on an adequate concrete base; that the upper layers or wearing surface of a pavement cross-section in concrete is worth twice as much as a bituminous-top wearing surface. Incidental to this conclusion is the use of an identical mix for a one-course concrete design and for the base of bituminous-top construction. "Obviously, a rational analysis of this problem has not been made and would be of very doubtful value. It appears to involve the analysis of a compound beam of elastic material, continuously but not uniformly supported on elastic bearings, and besides the question of flexure involves consideration of no less than three different longitudinal shears, one in concrete, one in the bituminous top, and one in the joint between them. The last element cannot possibly be evaluated, and the question of reduced impact owing to the cushioning effect of the bituminous top confuses the whole problem." Although this conclusion is unsatisfactory to many engineers and to a large group of material manufacturers, there has, nevertheless, been surprisingly little unfavorable criticism of it, probably because no one has any better data on which to base objections than the Illinois department had on which to base their conclusions.

The state of Pennsylvania in the 1919 specifications compared types on the basis of probable cost, and developed designs for such pavements as sheet asphalt, Filbertine and Warrenite having dimensions which departed from previous customary practice, because designed with the purpose of producing a cross-section of each type so that all would cost approximately the same. This plan possesses the inherent drawback that it must be entirely revised with every change in relative cost of materials.

The Bureau of Public Roads has tentatively followed another solution which starts by establishing a list of pavements on the basis of service value. This is purely empirical and indeterminate and likely to vary somewhat in the judgment of different engineers. The order in which pavements have been listed by the Bureau is as follows: Brick on concrete base, sheet asphalt on concrete base, cement concrete, bituminous concrete on an adequate base, bituminous macadam, surface-treated macadam, water-bound macadam, gravel macadam, gravel, sand-clay, top soil, earth.

The next step was to attempt to indicate sufficiently the details of design so that the pavements could be classified in groups. Three groups known as Classes A, B and C were selected, for heavy, medium and light traffic, respectively. Under Class A the bureau placed monolithic or semi-monolithic brick pavement, using 3 or 3½-inch block on 4-inch or 5-inch cement concrete base mixed 1:2½:5 or 1:3:6. Also bituminous concrete 2 inches thick on a 5-inch or 6-inch cement base mixed 1-3-6. Also cement concrete pavement 6 inches thick at the sides and 7½ inches at the center mixed 1-2-4.

For Class B, medium traffic, it designates bituminous concrete 1½ inches thick on a 4-inch or 5-inch concrete base mixed 1-3-6. Also cement concrete pavement 5 inches and 6½ inches mixed 1-2-4. Also bituminous concrete 2 inches thick on a 4-inch bituminous concrete base of crushed stone or gravel.

For Class C, light traffic, it designates bituminous concrete 1½ inches thick on a 4-inch bituminous concrete base of crushed stone or gravel. Also bituminous concrete 1½ inches thick on a bituminous binder course 1½ to 2 inches thick, on a 4-inch broken stone base. Also bituminous concrete 2 inches thick on a 5-inch water-bound macadam base. Also bituminous macadam 2½ inches thick on a 5-inch water-bound macadam base.

This classification was especially devised as a suggestion for the state of Idaho and there was included under Class A as a fourth alternate, bituminous concrete 2 inches deep on a 5-inch or 6-inch bituminous concrete base of crushed stone, this addition being solely for the purpose of providing in this group a type of surface that would not require water for construction. It is apparent that this classification is not generally applicable. For instance, Class A pavements should be made considerably heavier in most of the Eastern states, and numerous other variations in detail would have to be made for other localities.

"So many different questions have arisen regarding the determination of alternate and comparable types that it appears necessary to seek a solution in an entirely different direction. So far we have attempted to establish an equivalency of either cost or service value. . . .

"It has been suggested that an attempt be made to establish normal differentials among the several higher types that are likely to be brought together in competition. This normal differential presupposes the fixing of what may be referred to as a normal base price for each type on a given project, and this will be arrived at by a careful analysis of the materials entering into the construction of the design on the basis of their cost. Given a particular project on which it is intended to solicit tenders for sheet asphalt, modified Topeka, and concrete, the materials necessary to construct each type will be located and the cost of placing them into the work will be analyzed. This will provide for each type a very carefully compiled engineer's preliminary estimate. It need not represent the actual cost, but it will establish a normal basis of comparison and fix the normal differentials that may be expected to exist between various types. When the bids are opened, if the bid for concrete is below its normal base price and the bid for Topeka is above its normal base price, the concrete would be considered the better bid. If, on the other hand, sheet asphalt, although bid at a considerably higher cost, were below its normal base price, and concrete above its normal base price, the tender for sheet asphalt could logically be considered as the better bid. . . . The practical effect of this method is to avoid decision as to strictly comparable types or designs, and at the same time maintain competition. But that competition is no longer among the types; it is a competition of each type with its normal or base estimate.

"It is, of course, at once apparent that a suggestion of this kind can only be worked out under very intelligent engineering direction—it will mean that the engineer, after having selected his alternative designs, will first have to compute the quantities of cement, sand, chips, aggregate, bituminous filler and whatever other materials enter into the construction, locate probable sources of suitable materials and carefully analyze the cost of each one."

"Whether this scheme is practicable from a business point of view may be open to some question. It has some decided advantages. For instance, it has been noticed that concrete bids when brought into competition with bids for Topeka or

Warrenite on a concrete base have a marked tendency to rise until they are only slightly below the Topeka bids. If a differential were established, concrete would have to stay down where it belongs or it would be at a disadvantage. The cost of preparing preliminary estimates would be somewhat greater than at present and the estimates could not be based so generally on averages derived from records of past bids as they now are. It is probable also that a somewhat higher standard of preliminary engineering in general would be required to carry out this scheme successfully, because there would doubtless arise considerable differences, especially among material men, as to the fairness of the differentials established, and the engineer responsible for the computations would have to fortify his conclusions by very skillfully analyzed data."

Two Illinois Asphaltic Pavements

An asphaltic concrete highway pavement on a rich concrete base and a sheet asphalt pavement of unusually stiff mix are described by John B. Hittell. Materials hauled in 4-bag batches by twenty-five trucks and mixed on the job. Base roughened by corrugated roller.

Two asphaltic pavements constructed this year in Illinois were described in a paper before the American Society for Municipal Improvements by John B. Hittell, district engineer of the Asphalt Association. Mr. Hittell selected these two pavements because they represented types of construction recently designed which will carry a large amount of traffic, one being laid on a cement foundation with a rather unusually rich mix and the other containing a top mixture which was unusually stiff. One was a section of highway and the other a part of the $15,000,000 Boulevard Link improvement of Chicago.

ASPHALTIC CONCRETE PAVEMENT

The highway pavement was asphaltic concrete on a cement base. The State Highway Department of Illinois receives bids on alternate types of construction, Portland cement concrete and bituminous concrete, specifying that the latter shall be laid upon a concrete base 1 inch less in thickness than that specified for the concrete pavement and mixed in the same proportion, the bituminous wearing surface being 2 or 3 inches thick. In 1919, the state called for bids on four sections of the Chicago, Waukegan and Milwaukee road, and R. F. Conway Company of Chicago, with wide experience in the construction of all classes of pavements, was awarded contracts on two sections for asphaltic concrete and on the other two for cement concrete, the bids for the asphaltic concrete being about $7,200 greater per mile than those for cement concrete. Undoubtedly the highway authorities, in thus awarding the contracts, desired to avail themselves of an opportunity to make a fair comparison between bituminous and cement concrete highway construction, as the conditions for such comparison were ideal—the same soil, traffic and widths of roadway, a thoroughly equipped and experienced contractor, and the fact that the asphalt would connect at each end with a cement road. The asphaltic concrete section contains 85,436 square yards and is almost 8 miles long. At one end it connects with a cement concrete road 18 feet wide, 7 inches thick at the side and 8 in the center, mixed 1:2:3½. Part of the route was occupied by an old macadam highway, but this was narrower than the new road and because of the amount of grading was of practically no material value as a support for the pavement.

Long stretches of light cutting were encountered in the grading and for this a large Koehring grader was employed and at times 3-yard wagons were loaded at the rate of 75 per hour. At the end of one of the cuts where a 3-foot fill was made, the soil was such that horses mired themselves and were unable to move their loads. This was overcome successfully by employing a large caterpillar tractor hauling a train of three wagons.

In the early part of 1920 a central mixing plant consisting of two 4-bag mixers was used, the concrete being hauled in trucks 2½ miles to the point of construction. This was successful at first but had to be abandoned later owing to the inability of material producers to supply materials in sufficient quantities to operate the two mixers simultaneously.

At the time of writing this paper, August, 1920, the materials for concrete were being hauled in bodies mounted on a Ford chassis with a capacity for one batch of 4 bags of cement, sand and stone in the proportion of 1:2:3½. The truck first receives 4 bags of cement from the pile or car, then moves to the sand car where the sand has previously been shoveled into a box attached to the side of the car, from which it is emptied into the truck; which box holds twice the portion of cement and is readily moved from one point to another on the side of the car. The necessary amount of coarse aggregate is added, the amount being gauged by the size of the truck body. About 25 of these trucks were employed and were equipped with 4½-inch tires on the rear wheels which very materially helped to compact the subgrade. In fact, the district engineer of the State Highway Department stated that there was practically no rolling of the fine grade and that the condition of the sub-grade was excellent.

The concrete base is 6 inches thick at the sides and 7 inches at the center. On tangents the subgrade is flat, while on curves there is a super-elevation of 18-foot pavements varying from 2½ inches on a 2 degree curve to 18 inches on a 7 degree.

A Lakewood mechanical tamper has been used, but at the time of writing the compression was being obtained by a large wooden tamper operated by two men, one on each side of the roadway. The specifications called for no curbs, but the contractor and officials agreed upon constructing a curb 4 inches wide and about 3 inches high integral with the foundation.

Last fall, when work was first started, brooms were used to roughen the surface of the concrete and increase the adhesion of the asphalt, but this method was soon superseded by a hand roller designed by G. N. Lamb, district engineer of the State Highway Department, which consists essentially of 5 feet of 10-inch wrought iron pipe sealed at the ends, to which has been attached at intervals of 5 inches ordinary 1-inch angle irons.* The roller is operated by two men, one on each side of the roadway, and the corrugations are made at an angle of about 60 degrees each way from the center line of the road, leaving the surface grooving roughly diamond shaped. The result has been very satisfactory. The concrete is cured by use of wetted tarpaulins and afterwards by flooding, no earth embankments being used, however, as is is not considered possible to satisfactorily remove the earth afterward from the rough concrete.

The average progress of the concrete foundation was over 400 feet a day. Four thousand feet of finished roadway was laid in 1919. Concreting was started September 24, while binder and top were laid during the week of November 20. Owing to the lateness of the season the contractor ran these materials from a plant in Chicago, hauling it 17 miles in 7½-ton trucks. The penetration of the asphalt varied between 56 and 68.

In order to finish more than 7 miles of binder and top this year, the contractor has installed at Deerfield a 1-car Cummer plant with a capacity of about 200 tons or 700 lineal feet of completed bituminous pavement. Two tanks of about 18,000 gallons capacity, one for fuel oil and one for asphalt cement, will be used to guard against interrupted delivery of these materials. The haul will average 2 miles. The mixture for the binding course is composed of asphaltic cement, stone chips and fine aggregate, there being from 4½ to 6½ per cent of bitumen, 15 to 30 per cent of mineral passing 10-mesh, 40 to 70 per cent passing 2-mesh and retained on 10, and 10 to 30 per cent passing 1-mesh and retained on 2. The wearing course consists of coarse aggregate, fine aggregate, filler and asphaltic cement, there being 7½ to 9 per cent of bitumen, 7 to 10 per cent mineral passing 200-mesh, 20 to 30 per cent passing 40, 25 to 35 per cent passing 10, 8 to 22 per cent passing 4, less than 10 per cent passing 2-mesh and retained on 4, and 18 to 32 per cent passing 2 and retained on 10.

This road begins 19 miles from city hall, Chicago. A traffic count was taken on Sunday and Monday, August 8th and 9th, by George A. Quinlan, county superintendent of highways, on this avenue 15 miles from the city hall. There were counted 11,991 pleasure cars and motor trucks from midnight to midnight on Sunday and 2,721 on Monday; about 5 per cent of the total on Sunday being motor trucks and about 10 per cent on Monday. Probably any other day of the week would have shown more motor trucks. The Illinois motor vehicle law limits the maximum load on any axle to 16,000 pounds, although cities may increase this by 50 per cent within their own limits, and permits may be issued for specially heavy loads. When frost is leaving the ground, officials may prohibit the operation of vehicles having a gross weight of more than 5,000 pounds.

SHEET ASPHALT PAVEMENT

The sheet asphalt pavement is on the north and south approaches to the new Boulevard Link bridge, being laid in connection with the widening and extension of Michigan avenue from Pine street to Randolph street, Chicago. The roadway of the bridge is 54 feet wide and the approaches are 75 feet and 80 feet, respectively. 17,850 square yards of the sheet asphalt was completed in 1918 and the remainder was finished early this year. The specifications called for a concrete base 8 inches thick mixed 1:3:6; a binder course 1½ inches thick and a wearing surface. The binder contains stone from 1 inch down, sand and bitumen, there being 4 to 7 per cent of bitumen and 20 to 30 per cent of material passing a 10-mesh screen. The surface mixture contains about 10½ per cent of bitumen, 18 per cent of mineral matter passing a 200-mesh sieve, 21.6 per cent passing an 80-mesh, 38.2 per cent passing a 40-mesh, 10.5 per cent passing a 10-mesh, and 1.2 per cent passing a 4-mesh. On level stretches the crown on the 80-foot roadway is 10 inches with a parabolic curve, reducing to 9 inches on gradients. The contractor guaranteed the work for two years from acceptance, agreeing to keep it in perfect repair during that period.

This improvement was made solely to accommodate pleasure-car traffic between the two sides of the river and to provide separate roadways for commercial traffic to and from the railroad freight yards. Speeds of 25 to 30 miles are common. Busses weighing 10,500 and 11,500 pounds empty, with ordinance capacity of 50 and 60 persons, use the pavement regularly, while an even heavier one is now operating under temporary permit. On Sunday, February 29, 1920, 9,400 automobiles were counted on this road between 10 a. m. and 7 p. m. On the same road 900 feet further north of Chicago avenue on Sunday, July

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*A photograph of this was shown on the cover of last week's issue.

25, 12,700 automobiles were counted; and a count made on August 11 at another point on this avenue showed 36,665 between 7 a. m. and 7 p. m., averaging 50 per minute.

Autoists Leave $74,000,000 in California

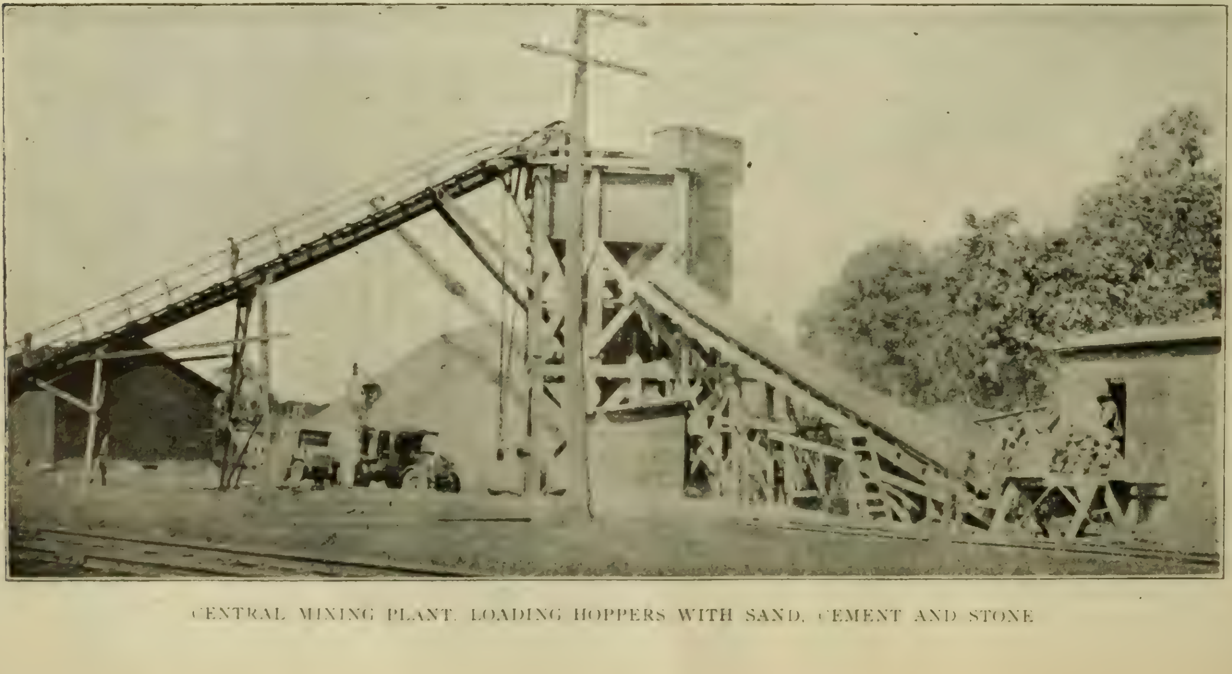
The State Motor Vehicle Department of California recently issued a statement that during the first six months of this year, 62,000 non-resident licensed permits were issued, and it is estimated that double this number will be issued for the entire year and that, estimating an average of four persons per car, an average stay in the state of one month (although many automobile tourists remain several months), and an average expenditure of $5 a day, this gives an estimated expenditure by visiting motor tourists during 1920 of $74,000,000. The California State Automobile Association believes that nothing like this number of tourists would be attracted to the state were it not for its excellent highways and that this amount can therefore be credited to the state highways as a partial offset to the cost of constructing and maintaining them.

Record Output for Central Concrete Mixing Plant

A paving contractors lays 355 cubic yards of seven-inch concrete pavement in a day, later increasing this to 425 with a maximum haul of 3¾ miles from a central mixing plant. This record was obtained by carefully planning and synchronizing every part of the work of transporting, mixing and spreading the concrete.

It is claimed that the world's record for a single day's production of concrete for paving work by a central mixing plant has been established by McCree, Moose & Co. of St. Paul, 912 lineal feet of 18-foot road averaging 7 inches thick, containing 355 cubic yards, having been laid by this company's central mixing plant in 10 hours. The record using the paving mixer method is said to be 308 cubic yards in 10 hours, made by Alan J. Parrish of Paris, Illinois. The state specifications on both jobs required a full minute mix per batch. These records would seem to indicate that the central mixing plant method can produce paving concrete with 15 per cent more speed than the paving mixer method.

The McCree, Moose & Co. contract covers 7½ miles of road running north and south from Big Lake, Minnesota, where the central mixing plant was located, giving a maximum haul for the mixed concrete of 3¾ miles. The roadway is 18 feet wide, 6½ inches thick on the sides and 7½ in the center, mixed 1:2:4. (The Minnesota state specifications required 1:2:3½ unless a machine tamper and finisher is used, in which case 4 parts of coarse aggregate may be used). The specifications for consistency require that the concrete, when placed and tamped in a cylinder 6 inches in diameter and 12 inches high and the form removed, shall have a vertical settlement of not more than 2 inches when machine finishing



CENTRAL MIXING PLANT, LOADING HOPPERS WITH SAND, CEMENT AND STONE is employed and not more than 6 inches when hand finishing is employed. As machine finishing was employed on this work, a dry mix was necessary.

The specifications require that concrete shall be mixed until it is homogeneous and uniform in color, remaining in the mixer at least one minute, and while the drum makes not less than 12 nor more than 18 full turns; requiring the mixers to be equipped with a timing device. The contractor used a 1-yard Smith tilting mixer and connected to this a batch meter of his own make which rang a bell at the end of the required number of revolutions of the drum but did not register the number.

This mixer had been used by A. Guthrie & Company in 1916 on the Calumet Sag channel, being then equipped with an electric motor. It was purchased by the present contractors and on the job herein described the power was transmitted by a long belt from a motor mounted near the ground.

At the central plant the cement in bags is unloaded direct from the cars into a warehouse. A belt conveyor leads from here to a hopper, which is directly over the mixer. The bags are opened in the warehouse and the cement, 6 bags at a time(this being the number required for 1 batch), is dumped on the belt conveyor which carries it up to the cement hopper.

The sand is brought from a pit 1¾ miles away by 2½-ton end-dump trucks, which deposit it through a trap on to another belt conveyor which elevates it to a second hopper which is located over the mixer and which has a capacity of 20 yards.

Crushed St. Cloud granite, which is used as coarse aggregate, is shipped to the plant in gondolas. A 1-yard clam-shell bucket on an 85-foot boom derrick unloads it from the cars directly into a third hopper placed over the mixer, which has a capacity of 25 yards. Additional crushed stone is unloaded into a stock pile behind the derrick, and the hopper is kept supplied from this pile.

Under the three hoppers is the batch hopper of the mixer, sub-divided to hold the correct proportions of sand, cement and crushed stone, which are fed into it from the hoppers above.

After having mixed the ingredients one minute, the mixer discharges the entire batch in 8 seconds into a bottom-dump hopper arranged just high enough to permit the trucks to drive beneath it, and having a capacity of 2 cubic yards of mixed concrete.

The mixed concrete is carried to the road by motor trucks of 2½ tons capacity, with specially short wheel base and equipped with end-dump bodies manufactured by the Lee Trailer & Body Company. They have a level capacity of 2 yards but were usually loaded with about 1½ yards of concrete.

After being dumped upon the sub-grade, the concrete is spread by horse-drawn scrapers and is tamped and finished by a finishing machine. The road is cured by the ponding method.

In carrying out the construction work, concreting was begun a mile and a half north of the mixing plant and carried toward the plant; then was begun a mile and a half south of the plant and carried north to join with the other section. Work was then started at the extreme northern end of the road and carried down to join with the first section, then at the extreme southern end working toward the second section. This enabled the trucks, during the construction of the third and fourth sections, to travel for a mile and a half over the new concrete road.

It was found that the amount of pavement laid depended upon the transportation facilities for

MIXER DISCHARGING INTO TRUCK WITH ORDINARY DUMP BODY, AT CENTRAL MIXING PLANT.

DUMPING CONCRETE FROM ORDINARY DUMP BODY TRUCK NOT ENTIRELY SATISFACTORY. NEEDS PERSUASION TO DISCHARGE ITS LOAD.

DUMPING CONCRETE FROM LEE END—DUMP BODY

handling the concrete rather than upon the mixing plant itself. Had more trucks been used the record made could undoubtedly have been exceeded. The amount and number of trucks also were governed by the distance from the plant. When paving not more than half a mile from the plant, 883 lineal feet was laid in one day using only 4 trucks. The 912-foot record was made on the end section, using 7 trucks traveling for 1½ miles over the completed concrete road. The contractor on this job also made an average daily record of 11,000 square yards, or 550 lineal feet, over a period of several weeks.

Comparing the central mixing plant method with the paving mixer method, it should be noted that the paving mixer had a capacity of ¾ yard of mixed concrete and was turning out a 1:2:3½ mixture instead of a 1:2:4. On the other hand, the central plant was somewhat handicapped by insufficient facilities for transporting the mixed concrete and therefore was not run at full capacity.

.. Since we wrote the above, these contractors have established a new record of 1,094 feet, or 425 cubic yards, of concrete in 8 hours. The company has finally gotten 12 trucks on the job and is expecting to exceed this record and may have done so before this article is read.

Machine Ditching Economical in Soft Ground

A drainage ditch has been constructed by the St. Louis and San Francisco Railway at Harvard, Ark., from 2 to 8 feet deep, 3 feet wide at the bottom and with side slopes of 1½ to 1, which required about 4,200 yards of excavation. It was originally intended to do the excavating by team work at an estimated cost of 60 cents per yard, but when the railroad forces arrived to execute the work it was found that the ground was so soft that the horses could not work on it, and it was concluded to try an American railroad ditching machine.

As the weight of the machine was too great to be supported directly on the ground, there was provided a special track supported on the center line of the ditch by movable sections of timber grillages or platforms that distributed the load equally to both sides of the ditch. Three sections of the platform, each 10 feet long, were made with an 8 x 10-inch transverse beam 16 feet long, supported at each end on a pair of longitudinal 3 x 10-inch planks 10 feet long, set close together. An 8 x 10-inch longitudinal stringer timber was placed flat under each rail and bolted on top of the transverse timbers. On these stringers 66-pound rails were spiked to suit the gauge of the ditcher machine.

A bearing of 32½ square feet was thus provided on the surface of the ground by these platforms and proved adequate to support the ditcher machine, which handled the platforms without difficulty, shifting the sections successively from rear to front as it progressed.

At the deepest part of the ditch the span of the track platform did not suffice for the ditch to be dug full width at the top. It was therefore dug to full bottom width and full depth and to partial top width, after which the ditcher machine advanced and, turning around, completed the ditch in the rear by widening it to the proper slope.

The total cost of executing this work in this manner was $550, or only slightly more than one-fourth of the estimated cost of doing it by teams. The cost of coal, oil, timber platform, installation and removal of ditcher was $85 and the remainder was for the wages of one ditcher operator, one ditcher fireman and one laborer for one and one-half months.

Improvised Dredge

Adjacent to an iron ore dock at Marquette, Mich., the depth of the water had been decreased from 23 feet to 16 feet by spilling the ore that was unloaded there and by accumulation of rubbish, so that it was necessary to dredge it out. The best bid received was $1 per yard with a guarantee for 15,000 yards, and was rejected as too high.

The dock company thereupon proceeded to deepen the water by force account work, using an American ditcher machine mounted on portable track sections on the deck of a 22½ x 50-foot barge. The ditcher was secured in a fixed position on deck and was equipped with a ¾-yard clamshell bucket. Besides removing the ore, it also brought up a large quantity of miscellaneous material, including boulders, wire and Manila rope, timbers and rubbish. It loaded into a bottom-dump scow of 30-yard capacity and had no difficulty in dredging to a depth of 23 feet at a cost of 40 to 50 cents per yard of material excavated. The bucket was operated at an average of one round trip per minute and at a maximum speed of 35 seconds. The material was excavated an average depth of 20 feet and lifted 12 feet above water, and as there was only one scow employed, considerable time was lost in the 20 or 30 minutes required to dump the scow and return it, after which about 1 hour was necessary to fill it.

PUBLIC WORKS

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Machinery for Snow Removal

Five years ago the use of machinery other than trucks in removing snow was so unusual that any instances of trials of such were published as novelties. Even for city streets, little use was made of anything other than horse-drawn plows or scrapers for shoving snow to one side, and only a few of the larger cities employed these; while in country roads little attention was paid to anything except the deeper drifts, and these were almost invariably cut through by hand.

How much development there has been in the past two or three years in the use of machinery for handling snow is indicated by the fact that New York, Philadelphia and other large cities are ordering snow plows, tractors and other machines by the hundred for removing snow from the streets; but even more by the extent to which the states themselves are preparing to keep the highways in the country districts open for traffic during snowy seasons. The State Highway Department of New Jersey owns 22 snow plows, but a few days ago authorized its engineer to advertise for 55 more. Massachusetts has bought 60 snow plows together with the fittings for attaching them to different makes of trucks.

In most cases the machinery so far adopted for regular use is confined to snow plows drawn by horses or trucks or pushed by trucks, but experiments are being made with numerous other devices such as rotary plows for throwing the snow entirely off of the roadway and adaptations of the elevating grader for lifting the snow from the roadway and discharging it directly into trucks.

One of the serious objections to making large investments in snow-handling machinery is the large amount of money tied up twelve months of the year which serves a useful purpose for only as many days or even less. It is highly desirable that machinery be used in the snow handling that can be used for other work during the summer; or be so constructed that the most expensive part of the machine can be used in ordinary summer work of highway and street departments.

Mix for Concrete Base

In a paper in this issue entitled "Selecting a Type of Road Surface," reference is made to the practice of the Illinois Highway Department of specifying the same mix for a one-course concrete pavement as for the base to receive a bituminous wearing surface. The engineer of the Bureau of Public Roads from whose discussion this was quoted states that this specification is not satisfactory to many engineers, but that they have no better data on which to base objections to it than the Illinois department had on which to base their conclusions.

In another article, also in this issue, entitled "Resurfacing Concrete Roads," the author holds that a very dense concrete is not so suitable as a base for asphaltic pavement as is a concrete of leaner mixture, and that a 1:3:6 concrete base is better under an asphaltic top than the richer mixtures used for concrete pavements; giving as his reason that the richer mixture is more susceptible to temperature changes and to developing cracks. In support of his opinion on this point he quotes a member of an engineering firm of wide experience in pavement work, who has formed his opinion from many years of observation.

There would therefore seem to be a decided difference of opinion on this point, which is certainly an important one in view of the millions of dollars being spent every year in constructing concrete base and utilizing concrete pavements as a base for bituminous top. If the state of Illinois, in requiring twice as much cement per cubic yard of base as is used by others, is not securing any better base and possibly even not so good a one, it is certainly desirable that it save the additional cost of the richer concrete.

It seems to have been the experience of engineers in other lines as well, that rich concrete develops more cracks than that which is somewhat leaner. For instance, it has long been claimed by sewerage engineers and contractors that a cement joint in a sewer pipe is tighter if mixed with one or two parts of sand than if neat cement be used, the latter being more apt to develop cracks which cause leakage. On the other hand, test samples of cement mortar generally indicate greater strength for those which contain the larger amounts of cement.

It has for some time been the writer's opinion in connection with the sewer joints, that the explanation lies in the probable fact that with mortar mixed with 1 or 2 parts of sand, the aggregate amount of cracking is perhaps as great as with the neat cement, but is distributed over a very large number of minute cracks, none of which is sufficiently large to be visible or to permit leakage through it; while with the neat cement the strength of the cement and the absence of the surfaces of sand particles along which cracks may form cause a tension throughout the entire ring of the joint which finally ends in a few large cracks developing at the points of least strength.

Similarly it seems probable that the same takes place in a concrete pavement. With rich concrete causing greater strength, internal tension is developed which results in cracks at considerable distance apart; while the leaner concrete, under similar conditions of shrinkage during setting, develops a large number of minute cracks which do not appear upon the surface nor affect the bituminous top, and to this extent the leaner concrete is probably preferable. It seems extremely probable, however, that in beam strength the leaner concrete is weaker, especially if the numerous fine cracks form as suggested, and that if such strength is a necessary or desirable characteristic of a foundation for such a surface, then in this respect the richer concrete would be the better base. The part that beam strength plays in supporting pavement surfaces is something concerning which we have very little information, although data now being collected should increase our knowledge on this point.

Undoubtedly many engineers and practical highway men have past experiences on which to base opinions pro and con on this subject, and our columns are open to a discussion of this subject from both theoretical points of view and based on experience. That it is an important one needs but a moment's consideration, in view of the thousands of miles of concrete base which is being laid every year in this country.

Comparison of Cost-Plus and Lump-Sum Building Contracts

In a discussion before the American Society of Civil Engineers of various forms of contracts, J. P. H. Perry, vice-president of the Turner Construction Co., stated that in the experience of that company, lower unit costs are obtained on the cost-plus basis than on the lump-sum basis.

Since May, 1902, that company had erected nearly 600 reinforced concrete factories, warehouses and other industrial buildings, executing about 750 contracts, about half of which have been lump-sum and the others cost-plus type contracts.

In 1917, the company built 22 factories or warehouses at a minimum cost of more than $100,000 and an average cost of $413,000. Thirteen of the buildings were built under the cost-plus form of contracts and nine of them were built under lump-sum contracts. The comparison of the two forms of contracts was based on a consideration of the three principal items of labor cost, (1) carpenter and labor work per square foot of floor required for placing and removing floor forms, exclusive of cost of making the forms; (2) cost of labor per cubic yard for all work in connection with mixing and placing concrete; (3) cost of labor for receiving, handling, bending and placing steel reinforcement.

The proper distribution of cost under these items was checked by the additional consideration of general expense as a percentage of the total payroll for each job, which varied by only about ½ of 1 per cent of the total cost.

Percentage jobs were cheaper than lump-sum jobs by 8 per cent for item 1 and by 2 per cent for item 2, and lump-sum jobs were the cheaper by 5 per cent on item 3 in the metropolitan district and by 2 per cent on the same item in districts outside the metropolitan district.

Mr. Perry considered that the cost-plus form of contract established a sort of partnership between owner and contractor and that each of them is more willing to make concessions and changes to secure greater efficiency and economy.

New York City Raises Salaries

Under a recent general readjustment of salaries, the city of New York has increased the compensation for all positions carrying a salary less than $7,500 per year. This will result in the following salaries to the engineers employed by the city: Twenty chief engineers will receive $7,450, fifty engineers will receive $4,470, eighty-six senior assistant engineers $3,420, one hundred seventy-one assistant engineers $2,760, fifty-six junior assistant engineers $2,370, sixty-four senior aids (chief instrument men and chief draftsmen) $1,700, two hundred eighty-five aids (instrument men and draftsmen) $1,500, and one hundred fifty junior aids (junior draftsmen and rodmen) $1,030.

These recent increases vary from 2 per cent in the case of the highest salary to 67 per cent for the lowest salary. Some time ago a committee on classification and compensation of engineers of the Engineering Council recommended salaries for these positions, and the salaries given above are substantially greater than those recommended for the two lowest grades, somewhat lower than those recommended for the three highest grades, and practically the same for the three medium grades.

Resurfacing Concrete Roads

By A. D. Stivers, M. Am. Soc. C. E.*

The writer believes that it is less economical to build a concrete pavement and resurface it with asphalt after a few years than to build an asphalt pavement at first, and that a leaner concrete than a pavement mix makes a better base.

Many highway engineers about to construct concrete roads contemplate re-topping these roads at some future date with an asphalt surfacing. This idea seems to be quite general even among those engineers who favor concrete roads to the exclusion of all other types. The past history of concrete roads and street paving in the United States certainly contributes to this belief. Recent developments in California and Maryland seem to indicate that it is easy to delay this resurfacing too long until the concrete becomes so disintegrated that it is not a fit base for asphalt pavement.

When a concrete road is subjected to traffic for a few years its original surface becomes roughened, slowly at first, and then more rapidly as the impact caused by the drop of the wheel load becomes greater as the depth of the depressions in the road surface increases. When the surface of the road becomes so rough as to cause inconvenience to traffic it is frequently decided to resurface the road and some form of asphaltic mixture is usually selected for this resurfacing.

The original concrete road then becomes merely the concrete base for an asphalt pavement. As such, the resistance of the concrete surface to abrasion is not important. Its function is merely to distribute the load of the traffic to the subgrade and to bridge over such weak spots as may exist in the latter.

The specification most frequently recommended for concrete roads at the present time is one part of cement to one and one-half parts of fine aggregate to three parts of coarse aggregate. This produces a concrete which is very dense and very susceptible to temperature changes, and which usually develops both transverse and longitudinal cracks soon after it is constructed. Prices for this class of work have recently shown a decided upward trend in this locality (Texas). During the past few months many bids have been rejected as being too high.

This very dense and high priced concrete is not as suitable a base for an asphaltic pavement as concrete of a leaner mixture. The latter is not so susceptible to temperature changes and does not develop cracks as readily as the former. Aside from all conditions of cost, a comparatively lean mixture produces a concrete base better suited for asphaltic pavements than the rich mixture now used in almost all concrete roads. It consequently follows that the worn out concrete road resurfaced with an asphalt mixture is not as good a road as one originally constructed as an asphalt road on a base of 1:3:6 or 1:3¼:7 concrete. This class of pavement base has given entire satisfaction in the past in many of our large cities and will give as good service on country roads as it has on city pavements.

Economy also favors the construction of a lean concrete base surfaced with an asphaltic mixture rather than a rich mixture concrete road to be resurfaced in a few years. Construction costs vary so widely in different parts of the country that it is impossible to consider this phase of the question in any but general terms.

A recent report of the Board of Estimate of New York City gives the average life of an asphalt surface under heavy traffic as eleven years. Adding to this the four or five years the concrete road will serve without resurfacing, gives the total life of the concrete road and resurfacing as fifteen years. The cost per mile per year of the concrete road resurfaced with asphalt is now from 15 to 35 per cent greater than the asphaltic road with a life of eleven years. Any engineer can easily work out the difference in cost for his own road when he has exact construction figures for his own locality available.

The trend of cement prices seems to be upward rather than downward at the present time and the difference in cost in favor of asphaltic construction will probably be greater in the future. If an engineer in charge of the selection of the type of surface for a heavy traffic highway believes that a concrete road is worth its cost for a few years of use and when it is worn out intends to completely rebuild it, he is entirely justified in recommending this type of construction. On the other hand, if he believes that this concrete road will soon have to be resurfaced with an asphaltic mixture resulting in an asphalt road inferior to one originally constructed as such, is he justified in recommending a 1:1½:3 base for an asphalt pavement?

(After the above had been written but before it was submitted to us for publication, it was read by some one presumably familiar with engineering principles, who criticized as fallacious the statement that rich concrete cracks more readily than lean. Wishing to be sure of his ground, the manager of the Asphalt Sales Department of the Texas Company wrote the following letter to A. W. Dow, of Dow & Smith, chemical and paving engineers, who made the reply printed herewith. —Editor.):

Mr. A. W. Dow,
Care Dow & Smith,
31-33 West 23rd Street, New York, N. Y.

Dear Sir:

One of the members of the Asphalt Sales Department has prepared a paper entitled "Resurfacing Concrete Roads" in which he makes the point that it is wrong for an engineer to design a high-class concrete road with the thought that two or three years from now, when the road starts to crack or shows signs of wear, he can cover the concrete pavement with a sheet asphalt wearing surface. The paper points out that for practically the same amount of money a lean concrete mixture can be used in the foundation for the sheet asphalt wearing surface and that the total cost of the two would not greatly exceed the cost of the original rich mixture used in the concrete pavement and, further, that a lean mixture wearing surface makes a better foundation than the rich mixture. I quote below from his article:

---

*South Western division, asphalt sales dept., The Texas Company.

> "This very dense and high-priced concrete is not as suitable a base for an asphaltic pavement as concrete of a leaner mixture. The latter is not so susceptible to temperature changes and does not develop cracks as readily as the former. Aside from all conditions of cost, a comparatively lean mixture produces a concrete base better suited for asphaltic pavements than the rich mixture now used in almost all concrete roads."

It is my recollection that in recent conversation with you on this subject you agreed with the writer of the article that a lean mixture is to be preferred.

Would be glad to have your comment on this feature.

Yours truly,
(Signed) W. H. KERSHAW, *Manager.*

New York, October 15, 1920.

MR. W. H. KERSHAW,
Asphalt Sales Department, The Texas Company,
17 Battery Place, New York City.

Dear Sir:

Your letter of October 8th was duly received, and I would say that I am in hearty agreement with the paper entitled "Resurfacing Concrete Roads" as far as you have quoted therefrom; that is, I do not believe that rich concrete is as satisfactory for foundation for bituminous pavements as is a lean concrete. I would not advise a concrete for this purpose richer than 1:3:6 or possibly, if the stone was of one size and coarse, a 1:3:5 mixture.

In a recent letter which I wrote to the *Engineering News-Record* and which was printed in their issue of March 11, 1920, criticizing an article by Captain Besson, I say that:

> "I do, however, wish to emphasize the fact that concretes 1:2:5 and richer are not only unnecessarily expensive but are undesirable for bituminous paving foundations. It is well recognizeed that rich concretes are much more liable to crack than lean concrete and these cracks not only weaken the foundation but often cause corresponding cracks in the wearing surface."

In February, 1919, in answer to a query on this subject from Mr. Linn White, chief engineer of the Chicago South Park Commission, I informed him that I could see no advantage in using a concrete as rich as 1:2½:5 and that my personal observations had led me to believe that foundations of rich concrete crack more easily and more frequently than those of lean concrete. Mr. White wrote me in reply and stated that my opinion agreed entirely with his own observations.

There are a number of engineers of long experience in concrete construction to whom I have spoken within the past few years on this very subject, who thoroughly agree with me, that rich concrete cracks much more readily than does lean concrete. One engineer, of whom I think very highly, said that he did not know of any one of experience who could think otherwise. It seems to me only necessary to compare the present rich concrete road surfaces which are being laid throughout the country with the leaner concrete foundations which have been constructed for bases under bituminous pavements in order to fully substantiate the fact that these rich concretes crack more readily than do lean ones. From a careful study of the subject it is very evident that these cracks do not come from the settling of the foundation owing to a giving way of the sub-grade, nor are they necessarily due to upheavals from frost, as this phenomenon takes place in the South, where there is no frost, to as great an extent as in the North. In the fall of 1917 I was examining some concrete laid preparatory to surfacing with sheet asphalt on a country road, and when the engineer informed me that it was a mixture of 1:2:4, I warned him that it was a dangerous mixture to use because it was much more liable to crack than a poorer concrete and would recommend him in future using a 1:3:6 mixture. It just happened in this particular case that, owing to delays caused by war conditions, the concrete was not covered with wearing surface until the following spring. At that time it was found to be cracked in many places both transversely and longitudinally. I believe that many engineers are making a mistake in laying concrete roads at the present day in the expectation that when they begin to wear or crack badly they can then surface with a bituminous surface. Such worn out or cracked concrete is surely not a desirable foundation and can only result in the early failure of a bituminous surface laid over them.

Very truly yours,
DOW & SMITH,
By A. W. DOW.

Digging a Ditch With Dynamite

By G. G. Means

Grand Lake, Minn., contains about three square miles of water and connects with two other small lakes along the side of which runs an expensively constructed highway. Owing to excessive rains, this lake rose two feet higher than normal and backed into the other smaller lakes, which thereupon overflowed and damaged a considerable part of the highway. John J. Harrison, the district engineer, asked that the water level of these lakes be lowered the two feet by which they had been raised, and lowered quickly.

On one side of Grand Lake was a large swamp which drained into a creek and was divided from the lake by a bank about 30 feet wide and two or three feet higher than the level of the creek. It was decided that the best way of lowering the water was to cut a ditch from the lake to this swamp and allow it to drain into the creek which drained the swamp.

It was impracticable to use hand or team work in digging the ditch and it was decided to excavate it by use of dynamite. A line of holes was put down 18 inches apart and 4½ feet deep. Four cartridges of straight NG dynamite 1⅛ x 8 inches were loaded in each hole, a blasting cap and length of fuse being placed in the middle hole of the row. The charges in all the other holes were set off by the concussion caused by the detonation of the primed charge in the central hole. The result of this blast was a ditch 10 feet wide at the top, 6 feet wide at the bottom and about 5 feet deep. Water immediately rushed through the ditch in large volume and cleaned it out thoroughly and during the next few days considerably enlarged the ditch so that no shovel work was required. Another ditch was dug twice as wide and of twice the capacity by putting down two parellel rows of holes 3 feet apart, the holes in the two rows being staggered and being 18 inches apart in each row. A primed charge was placed at mid-length between the two rows and both rows discharged by the one blasting cap.

The soil at this place was black muck saturated with water and underlaid with a solid layer of sand. Had it been dry or even moist ground, the use of dynamite in this way would not have been successful. As it was, the ditch was opened up clean down to the sand. The work was done hurriedly and the amount excavated was not measured nor was the cost figured exactly, but it was estimated to have been about 15 cents a cubic yard. With the opening of these ditches the lake rapidly lowered and it became possible in a few days to make permanent repairs to the road.

Columbus Municipal Reduction Plant

By Walter D. Bee*

A few points learned during the ten years' operation of this plant—how to prepare tankage to obtain the highest market price, the purchasing and recovery of solvents, and the relation between garbage and the plant products.

In treating garbage at the municipal plant of Columbus, Ohio, the garbage is first cooked with live steam, then pressed through continuous roller presses. Tank liquor from the presses goes to the grease separating tanks and from these to storage. The tank liquor is drawn from storage as needed and passed through vacuum evaporators. Solids from the roller presses go through the first dryer, and then to the percolator for final de-greasing with gasoline. After percolating, the tankage is mixed with all the stick liquor it will hold, and again dried, the final operation being sizing and grinding.

PREPARING TANKAGE

The first point to be covered is the manner of drying the tankage so as to produce a merchantable article. At the Columbus plant the tankage is dried twice, as above noted. As it comes from the presses the tankage contains from 65 per cent to 75 per cent of moisture. This moisture content is reduced in the first drying to about 10 per cent or 12 per cent, or dry enough for the material to be "wetted" with gasoline.

After final de-greasing with gasoline as the solvent, the tankage is passed over a one-half-inch mesh screen, all material too large to go through the openings being rejected as of no further value. That which goes through the screen is then conveyed to the mixer where enough stick liquor is added to make the mixture so thin that it will "run" rather than "pile up." This makes a pretty wet product to dry in one operation, but we do it in a direct-heat dryer and the tankage comes out as a hard, granular substance with an average of about 3 per cent moisture.

It has been our experience that the mixing is the particular place where both the quality and the weight of the finished tankage may be most easily influenced. The more stick that can be added, the better and heavier will be the resulting tankage. The average annual analysis of Columbus tankage runs about 3¾ per cent ammonia, 1 per cent potash, and 7½ per cent bone phosphate, and we receive very few dead animals to help boost the ammonia.

Since learning the importance of the stick in the finished product, we have been able to command a better market at a much higher price than is obtained for other tankages which have not been so carefully manufactured. In fact, we are at present getting almost as much per unit as is being paid for high grade animal tankage.

SOLVENTS AND THEIR RECOVERY

The second point to be discussed is that of solvents and their recovery. Gasoline has always been used at the Columbus plant, and up to the time this country entered the war there was no particular difficulty in securing the grade desired. During the war, however, we had to take what we could get and be glad we got it. The result was that there was considerable loss of solvent due to high boiling points.

Last year and this we have been able to get a good grade of gasoline by carefully specifying what we wanted and then distilling a sample from the car to see if it was up to specifications. Several cars have, during the last ten years, been rejected and turned back to the refiners because of high end points. As our power plant operates at 115 pounds steam pressure without superheat, we are limited in the temperature we can obtain in the percolator when "steaming out."

We specify a straight-run gasoline which will distill off at least 95 per cent at 300 degrees Fahrenheit, and then watch the car sample to see that the distillate comes off reasonably uniform. Ordinary motor car gasoline does not distill readily with steam, and in addition is not nearly so good a grease solvent as the "high test" variety. Our loss of solvent averages a little more than one gallon per ton of garbage treated, and has varied considerably from year to year, due to condition of plant and grade of gasoline used.

GARBAGE

As a last point for discussion, I believe a short review of general garbage conditions during the last ten years in Columbus will be of interest and show to what extent the people responded to the appeal to conserve food during the war.

Up to, and including 1916, the city collected garbage once a week during cool weather, and twice a week through July, August and September. Beginning with the year 1911, the garbage increased from 190 pounds per capita to 218 pounds in 1915. In 1916, the last year of twice-a-week summer collections, the decrease started with 203 pounds per capita. Since 1916, collections have been on a weekly schedule throughout the year, and the slump continued to 1918 with a per capita of 138 pounds. Last year showed an increase to 157 pounds, and this year promises to add a further substantial increase.

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*Superintendent, Division of Garbage Disposal, Columbus, Ohio.

That the quality of garbage is best indicated by its grease content is shown by the fact that we have been able to hold the tankage production almost uniformly at a hit more than 10 per cent of the green garbage weight. We feel that the quantity of tankage that can be produced from a ton of garbage depends more upon the care and completeness of manufacture than on the richness of the garbage.

Taking this fact as a basis, I do not believe that the quality of the garbage varied much from year to year, until 1916, when wages had advanced considerably, but commodity prices had not, as yet, gone up in proportion. Previous to 1916, grease recoveries were fairly uniform at about 2½ per cent. In 1916, more than 3 per cent of grease was obtained. Since then, grease recoveries have decreased until last year less than 2 per cent was produced. So far this year the quantity of grease secured indicates that the low point was reached in 1919, and with a further decline in the price of food, the grease content or richness of the garbage should slowly increase.

The above is a paper read before the American Society for Municipal Improvements at St. Louis.

Highway Maintenance in Nebraska

The patrol maintenance system of the highways of Nebraska was organized in April, 1920. Each of the five division engineers held meetings with the county boards of his county and took up the matter of highway maintenance in that county, including the amount of funds available. Work was started as promptly as possible and a fairly good mileage has already been covered.

Three methods are being employed—by team, by truck, and by tractor. The team patrol consists of one man who furnishes his own team, a farm wagon, a 6-foot blader, a planer, a scraper or fresno, a plow and small tools. The team patrol receives an average of $175 per month, which is the total cost to the county.

In maintenance by truck patrol, two men are required who receive $120 a month and the gas and oil for the truck is furnished by the county, which is reimbursed by the state. The trucks used are a part of the equipment turned over to the state by the War Department and the counties were charged the freight and expense to the state of obtaining them, averaging nearly $1,000. If purchased at market value they would cost between $3,500 and $5,000 each. The equipment for a truck patrol includes the truck, a scraper, a maintainer, two planers, a plow and small tools.

The tractor patrol method also calls for two men and is used in counties where such equipment was already on hand. The equipment consists of two small tractors, two highway maintainers, a plow, a planer, a buck-scraper and small tools.

The team patrol is given a section averaging six miles in length, the truck patrol section averages seventeen miles, and the tractor patrol averages fourteen miles.

The state had in its possession at the beginning of the season over two hundred army trucks available for use on the state roads and it seemed advisable to use these where there was a large mileage to cover. Last fall teams had been hard to find, the army trucks were not yet available, and the State Highway Department recommended to certain counties that they purchase light farm tractors with which to pull the highway maintainers. These conditions had much to do with the developing of these three types of maintenance.

The Department of Public Works (which has charge of highway work in Nebraska) reports that for all-round careful patrol the team cannot be excelled, as it is much easier to stop and fix ruts, small chuck holes and the like when driving a team than when driving a tractor or a truck. The amount of work accomplished is entirely dependent upon the patrolman, for a conscientious patrolman will work diligently, doing the most careful work possible in the shortest length of time. For this reason among others, the Wisconsin State Highway Department favors the team patrol. In Nebraska, however, where there is a large mileage to cover, it is believed that the truck is perhaps the most economical and the best type of patrol.

The cost of maintenance depends largely upon weather and soil conditions. The condition of the road will regulate the number of times it will have to be gone over. Whether a team or a truck is better will depend to a certain extent on the condition of the road. For instance, on a newly constructed grade with deep fills, the larger part of a team patrolman's time will be spent in using the slip, while on a more level road a truck highway maintainer will take care of 90 per cent of the work.

On the basis of four months of continuous operation, the department has made some comparative cost analyses. These, however, do not take into consideration the conditions of the soils on the various roads, nor the weather, both of which have considerable effect upon the cost. The figures are given as representing the cost of the three kinds of patrol maintenance per day per mile, this including depreciation on state-owned equipment as well as on that owned by the county. The total maintenance cost by tractor patrol in five counties for the three-month period of April, May and June, was $7,532, or $1,506.40 for one county, or $1.38 for one patrol per mile per day. The average for eleven truck patrols during the same months was $1,244.79, which averages 94 cents for one patrol per mile per day. The average for ten team patrols was $649.32 for the three months, or $1.38 per mile per day. The cost per day for the several patrols was $19.31 for tractor patrol, $15.96 for truck patrol and $8.32 for team patrol; the cost per mile per day being obtained by dividing these by the average length of section maintained by each patrol. Comparing the patrols on the basis of equal length of road covered, the cost of team and of tractor patrol was found to be practically the same. It would appear, however, as stated above, that the truck patrol is the most economical and is considered by the department the best type of patrol.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail ,it may help some one.

Excavating Small Earth Trenches

The installation of gas, water, sewer and drain pipes involves the excavation annually of thousands of miles of trenches from 1 to 3 feet wide and from 2 to 10 feet deep. When these are made in hard-pan, rock or indurated strata, it is usually a simple question of picking, barring, drilling and blasting which affords little variety of operations and requires simple, careful work and good judgment.

In clay or dry solid earth or in firm, moist sand the excavation is usually an easy matter either by hand or by the aid of various standard and special appliances. For very soft wet ground, sand, silt, mud and quicksand the work is more difficult and costly and requires special precautions to prevent the earth from caving in or the trench from filling with water.

The most advantageous method of work will, of course, depend on the dimensions of the trench, the length to be dug, the character of the ground, the location in country roads, city or village streets or in open fields, the rapidity with which it must be executed, and the equipment available for the purpose.

In the streets of a large town or city where traffic is heavy or the streets have costly pavements and obstructions may be encountered in doing it, the work is generally done under the direction and according to the requirements of the engineer and little choice remains, the trench being generally excavated by hand and opened in short sections with the least possible obstruction of the streets. In other cases where there is only a small quantity of trench to be excavated or where there are unusual conditions of soil, locality, topography or other features that make it very slow and difficult, it will also probably be necessary to do it by hand in whatever manner suggests itself as most suitable for the circumstances.

MACHINE EXCAVATION

If there is an unusually large amount of trench and the conditions are favorable for excavating by power plant, it may be profitable to install an expensive equipment, but unless it is already available a careful estimate should be made of the cost of purchase or rental, of installation and removal, of maintenance, operation, fuel and other supplies, depreciation, overhead charges and salvage; and the total of these items should not exceed the cost of doing the work by hand, although the latter may appear much more expensive than the direct cost of operating the mechanical equipment. Of course several miles of work, such as irrigation ditches or long lines of drainage or the necessity of completing a long trench with rapidity, may justify mechanical installations that would not otherwise be advisable.

Digging with spade, shovel and pick-ax, although always slow and costly, may often be the most desirable for very shallow, narrow trenches, especially when hand work is necessary to trim and finish the trench before the pipes can be laid. If the depth is more than 6 to 8 feet it becomes difficult to shovel out the material and it is frequently necessary to throw it to a platform half way up, from which it is shoveled to the surface at a greatly increased cost.

HORSE-HAULED EQUIPMENT

The excavation of trenches 12 inches wide and less than 2 feet deep can be much facilitated by the use of a ditching plow drawn by two horses that drag a vertical U-shape cutting blade which merely loosens the earth that is afterwards thrown out by shovels. Another plow making successive 6-inch cuts loosens the soil of trenches up to 8 inches wide and 3 feet deep, afterwards it also is thrown out by shovels.. Most of these plows require two or three horses to haul them and two men to operate.

A larger 3-bladed plow drawn by six horses will, under favorable circumstances, excavate 2,000 feet of 12-inch trench of 24 to 30 inches deep in 10 hours. This machine not only cuts and loosens the earth but elevates it to the surface. There are various other types and sizes of horse-drawn machines equipped with plows or cutting knives and with elevating devices that in favorable soil will cut trenches 5 or 6 feet deep and 8 to 14 inches wide. For larger trenches there are on the market a number of power-driven machines that give excellent results under favorable circumstances.

The advantageous use of trench cutting machines is obviously where trenches are of considerable length and in soil that is free from obstructions, cuts easily and will stand for several hours or days with an unsupported vertical face of the depth of the trench. If the latter quality is doubtful, it is important to lay the pipe as rapidly as possible after the trench has been opened, which, of course, is much more easily done if the machine cuts to the full depth at the first trip. In such cases where the sides of the trench have a tendency to cave in, a shield is sometimes drawn along by the excavating machine and protects the trench while the pipe, usually tile pipe, is laid rapidly in the rear as the machine advances.

SPECIAL SYSTEMS

For wider and deeper trenches, excavating machines are generally replaced by separate or combined systems of excavating and removing the soil and the operations are likely to be prolonged so that in treacherous soil support is more likely to be necessary for the sides of the trench. Where the work is done by hand because many obstructions are likely to be encountered that have to be blasted or excavated around, a system of one or more fixed or movable derricks to hoist buckets or boxes of spoil from the trench may be used. A number of systems of overhead rail trolleys and other conveying systems, including cableways with fixed or movable towers, have been used but their high first cost and cost of installation and moving are not justified unless the work is of considerable magnitude or importance.

Unless there is room to store the spoil alongside the trench until the latter is back-filled, some system of disposal must be provided, and generally is necessary, for disposing of the surplus of the excavated material corresponding to the swelling by handling and to the volume occupied by large pipes installed, especially in city streets where the pavement must be restored to its exact elevation. This can be provided for by trucks or industrial cars on temporary service tracks, or, if the trench is opened up at several places simultaneously and the operations are carefully synchronized, derricks with long booms may suffice to hoist the spoil from the point of excavation and dump it with the same movement at the point of back-fill. This, however, is likely to be much better accomplished by a cableway or overhead trolley system that will enable the soil to be handled several hundred feet and thus increase the working limits.

DRAG-LINE EXCAVATION

For trench excavation in gravel, in hard stratum that does not require blasting, and below ground-water level, as well as for large trenches in very soft materials, the work may sometimes be done to advantage by a drag-line scraper, using one of several forms of drag-line bucket that are so designed as to load, carry and dump by manipulation of the lines with which they are operated by a hoisting engine. These buckets require a considerable longitudinal motion besides their hoisting range and, in the regular drag-line machine, are generally operated from a long derrick boom mounted on a movable platform that advances along the line of the trench. It may, however, be operated from any kind of a boom, from a cableway or from a fixed line carried from a mast to an anchorage. The latter methods do not permit much transverse shifting of the material, while the derrick boom method allows it to be dumped anywhere within radius of the boom.

A simple and efficient drag-line equipment for small work may be improvised from a double-drum hoisting engine, a shear leg and overhead cable and the operating lines. The cable is installed in the line of the trench with both ends securely anchored and with the elevated end over the hoisting engine. The hoisting engine operates a tail line and a hauling line that respectively carry the bucket on the cable trolley to a point between the hoisting engine and the anchorage where it is lowered, and haul it back excavating a load of earth which is then hoisted and pulled along on the cable until it is dumped at any required point in the line of the trench.

If it cannot be dumped in position for back-fill, it may be dumped over as an elevated hopper from which cars or trucks may be loaded and the spoil removed.

A very simple arrangement may be provided by eliminating the cableway and operating a drag-line by an endless cable running around an anchored sheave at the end opposite the hoisting engine. In order to hoist the drag-line bucket from the bottom of the trench, some kind of an artificial incline may be provided which may be easily made with a movable timber platform having a trap near the top, over which the hoisting engine, beyond the incline, hauls the bucket and automatically dumps it through the trap into a hopper or waiting car or truck. Such an apparatus two or three hundred feet long may be made from equipment easily obtained from almost any contractor, or can be purchased in the market.

DREDGING AND DYNAMITING

Very large trenches for irrigation and especially for drainage work, are often made advantageously by regular dredging machines with dipper bucket or with bucket ladders that can be lowered to position and around which a chain of buckets travel continuously hoisting and discharging the material. Some of these dredges are mounted on special narrow pontoons that are floated through the trench they cut while others are moved forward on the surface of the ground.

Small ditches in ground so soft and swampy that it was almost impossible to work by ordinary hand digging, have been blasted with dynamite. Holes a foot or two apart on the center line of the trench are easily punched to a depth of 1 or 2 feet by a stick and are charged with sticks or half-sticks of dynamite that are simultaneously exploded, making, under suitable conditions, a satisfactory drainage ditch with great rapidity and economy. The use of dynamite charged in holes made by a driven rod or auger in hard ground, is also very efficient in loosening and to some extent in removing the earth for ditches and drains on dry land. When the ditch is to be used for pipe laying, it will, of course, be necessary to dress the bottom and sometimes the sides to secure the proper grade and clearance for the pipe.

Recent Legal Decisions

PROCEEDING TO GRADE STATE HIGHWAY OBTAINING RIGHTS OF WAY CONTRACTING

The Oregon Supreme Court holds, Rockhill v. Benson, 191 Pac. 497, that a proceeding of the state highway commission to grade a highway cannot be enjoined by a taxpayer of the county because of the failure of the commission to obtain some of the rights of way before the grading contract was let. The provision of Laws 1917, p. 447, that the right of way shall be acquired before any contract shall be let is not mandatory on the commission, or prohibitory of the letting of such a contract for such a reason. Where the route adopted by the commission for a state highway would be shorter, the maximum elevation would be considerably less than those afforded by the existing county roads, and there was a question, and room for the exercise of judgment, as to whether it would not ultimately be the cheaper route, the Supreme Court would not interfere with the conclusion of the commission, which it must assume, in the absence of evidence to the contrary, was honestly and conscientiously applied to the facts of the case.

CHEAPNESS AND DESIRABILITY OF OTHER ROUTES NO OBJECTION TO ROAD

In a suit to restrain the construction of a road on a particular route, the Texas Court of Civil Appeals holds, Tippett v. Gates, 223 S. W. 702, that allegations of the comparative cheapness and desirability of other routes do not of themselves constitute any legal ground of complaint. The expense of constructing any particular road is not a proposition the courts can primarily concern themselves about. It is a proposition which belongs entirely to exercise its discretion without further interference. Neither did the fact that more "low, wet and marshy" land will be crossed in building the road afford any legal ground of complaint, notwithstanding the provision of the law that no road shall be laid out or constructed upon such land, except where it is necessary to build directly across it. The Legislature did not intend by this provision to destroy or limit the discretion of the road board and prescribe a rigid rule for road construction across such lands.

STREET EXTENSION MAY BE MADE AT ANGLE WITH EXISTING STREET

The Court of Appeals of the District of Columbia holds, Briggs v. Brownlow, 265 Fed. 985, that the commissioners had discretion, in making a street extension authorized by a special act, to make the extension at an angle with the line of the existing street between the designated terminal streets, and that it was not necessary that the extension continue the existing street in a straight line.

"STREETS" IN STATUTE NOT INTENDED TO INCLUDE "SIDEWALKS"

In determining the meaning of the words "roads" and "streets," as used in statutes, the Alabama Supreme Court holds, City of Mobile v. Harker, 85 So. 425, that not only should the language of the statute be considered, but also the character of the subject. The difference between the public roads of a county and the streets of an incorporated town or city was recognized in McCain v. State, 62 Ala. 138, where it was said that to hold a public road brought within the boundaries of an incorporated town to be still under the jurisdiction of the court of county commissioners would be very unnatural. And in Benton v. City of Girard, 168 Ala. 175, it was pointed out that the city government and the county authorities have separate and distinct functions, and that the duty of keeping in repair the public roads of the county rests with the commissioners' court, but not the streets of any city in the county. It is held that the word "street" as used in Loc. Acts 1907, p. 727, par. 1, divesting the city of Mobile of and investing the county with the control, management and supervision of the streets named therein, was not intended to include sidewalks, which still remain under the control and supervision of the city, which is liable for injuries arising from defects therein.

DEFECTIVE PROCEEDINGS NO FOUNDATION FOR PAVING CONTRACT

Where a property owners' petition for the paving of a street in New Orleans was not signed by 52 per cent or more of the owners of property on the street, as required by the city charter, the Louisiana Supreme Court holds, Grasser Contracting Co. v. Richardson, 85 So. 609, that it was illegal, null and void, and could not serve as a foundation for a contract for the paving, particularly as the owner sued had filed a timely protest against entering into the contract. The illegality of the petition having been brought to the knowledge of the city and presumably to that of the contractor prior to his entering into the contract with the city, and the defect being a radical one, the plea of estoppel was not available to the contractor against the owner under the Louisiana Act of 1914, No. 219.

CLAIMING DAMAGES FOR LOCATION OF ROAD WAIVES IRREGULARITIES

The Nebraska Supreme Court holds, Witherwax v. Holt County, 178 N. W. 925, that where a landowner files a claim for damages caused by the location of a public road over his land, he thereby waives all objections on the ground of irregularities in locating the road. Jurisdiction of the county commissioners to locate a public road having been shown, all subsequent proceedings will be liberally construed, and a substantial compliance with the statute will be held sufficient.

NEWS OF THE SOCIETIES

Nov. 8-12—LEAGUE OF CALIFORNIA MUNICIPALITIES. Annual Convention, Chico, Calif. W. J. Locke, Pacific Bldg., San Francisco, Calif

Nov. 10-12—NATIONAL DRAINAGE CONGRESS. Chicago, Atlanta, Ga.

November 12—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Second Fall meeting, Chicago. Sec., 33 W. 39th St., New York.

Nov. 12—CONFERENCE ON EMPLOYMENT AND EDUCATION, sponsored by the American Assn. of Engineers Chicago

Nov. 12—AMERICAN ROAD BUILDERS' ASSOCIATION. Annual meeting. New York City.

Nov. 15-17—CITY MANAGERS, ASSOCIATION. Annual convention at Cincinnati, O. Executive Secretary, Harrison G. Otis, 812 Tribune Bldg., New York City.

Nov. 18-19—AMERICAN ENGINEERING COUNCIL. Organization meeting. Washington, D. C.

Nov. 18-19—FEDERATED AMERICAN ENGINEERING SOCIETIES. Annual meeting. New York; Washington, D. C.

Dec. 7-10—AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual meeting, New York. Secretary, 29 W. 39th St., New York City.

Dec. 9—THE BROOKLYN ENGINEERS' CLUB. Annual Meeting, election of officers.

Dec. 13-16—AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS. Annual convention. Washington, D. C.

Dec. 16-17—THE KANSAS ENGINEERING SOCIETY. Annual meeting. Topeka, Kansas.

Jan. 25-27, 1921—THE AMERICAN WOOD PRESERVERS ASSOCIATION. Place of meeting to be announced later.

Jan. 25-27—ASSOCIATED GENERAL CONTRACTORS OF AMERICA. Annual convention. Washington, D. C.; New Orleans.

Feb. 7—AMERICAN ROAD BUILDERS' ASSOCIATION. Annual convention. Coliseum, Chicago. E. L. Powers, 11 Waverly Place, New York City.

AMERICAN ROAD BUILDERS' ASSOCIATION

Representatives of fifteen industries identified with highway construction held a meeting at the Automobile Club of America October 22 to complete the organization of an advisory committee of manufacturers to co-operate with the American Road Builders' Association in holding a great exposition of highway equipment and materials in connection with the association's annual convention which will be held at the Coliseum, Chicago, during the week of February 7, next.

The industries represented at the forthcoming exposition will include sand and gravel; crushed stone; Portland cement; asphalt and oil; tar; granite block; paving brick; slag; road building machinery; quarrying machinery; excavating machinery; trucks, tractors and trailers; concrete mixers; engineering instruments, and explosives. It was developed at the meeting that upwards of one billion dollars is annually available for highway and street work and that a genuine necessity exists for capacity production and distribution of highway materials and equipment.

An executive committee to represent the producers and manufacturers was appointed consisting of J. E. Pennybacker of the Asphalt Association; B. H. Wait of the Portland Cement Association; W. T. Chollar of the Lakewood Engineering Company; D. C. Fenner of the International Motor Truck Company and P. P. Sharples of the Barrett Company. A Chicago committee was also appointed with S. F. Beatty of the Austin-Western Road Machinery Company as chairman.

The Virginia Good Roads Association has formed a women's advisory council with a woman for chairman.

AMERICAN ELECTRIC RAILWAY ASSOCIATION

At the Atlantic City convention, October 14, it was resolved that in the regulation of public utilities, "such common sense economies and business principles," be applied, "as will restore credit and enable electric railways to perform their full public service." W. S. Murray, chairman of the superpower survey of the United States, told the convention that a saving of thirty million tons of coal and $300,000,000 a year would be effected by the proposed linking of the power plants of the Atlantic seaboard.

The association voted to widen its membership so as to include investment bankers and consulting engineers whose business brings them in contact with the industry.

H. H. Gadsden of Philadelphia was elected president and E. B. Burritt, New York, secretary-treasurer.

NEW JERSEY STATE HIGHWAY CONVENTION

In order to better co-ordinate activities of the Highway department in the state of New Jersey, it is proposed to hold in Trenton this winter a two-day convention of all the departmental employees. This will include division engineers, assistant engineers, road inspectors, foremen, heads of various units, members of field parties and all others concerned in road construction.

There will be an exhibit of road building materials for the information of employees and others, which will clearly demonstrate what materials will satisfy state standard specifications and what will not pass. It will be held in the laboratory of the Highway Department.

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS

The American Association of State Highway Officials have been obliged to change their convention date owing to lack of hotel accommodations. The convention will be held in Washington, D. C., on December 13, 14, 15 and 16, instead of December 8, as previously announced.

CITY MANAGERS' ASSOCIATION

At the annual convention of the City Managers' Association, to be held November 15-17, in Cincinnati, Ohio, several papers on paving materials will be presented. Two topics which will receive discussion are: "A Model Paving Program for a City of Twenty Thousand" and "The Relation of Motor Trucks to City Business."

KANSAS CITY ENGINEERS' CLUB

The Engineers' Club has been strenuously engaged in securing the adoption of amendments to the state constitution providing means for raising the bonded indebtedness for Kansas City in order that sufficient bonds can be voted for a new water plant and filtration system.

At a meeting of the club on October 22 resolutions were adopted endorsing amendments to the state constitution providing for a sixty million dollar bond issue for good roads in Missouri, and for a Kansas constittuional amendment providing for state aid for the construction of roads in Kansas.

POLITICAL CANDIDATES STATE THEIR VIEWS

Mr. Nathan L. Miller of Syracuse and Governor Alfred E. Smith, as candidates for the gubernatorial election have replied to the questionnaire submitted by this chapter. The answers submitted by Governor Smith explain the questions asked.

"1. I am in favor of the establishment of a budget system for all state expenditures.

"2. I am in favor of the establishment of a bureau of public works under efficient engineering direction.

"3. I favor placing the planning, construction and maintenance of a comprehensive and modern highway system under such a bureau.

"4. I favor the appointment of competent engineers as a part of the membership of public service commissions and other bodies supervising work largely of an engineering nature.

"5 I am in favor of seeking in an aggressive manner a solution of the problems involved in making New York City the foremost part of the world."

Mr. Miller replied: "I am glad to be able to answer all of your questions categorically in the affirmative."

ASSOCIATED GENERAL CONTRACTORS

The Associated General Contractors of America headquarters has been moved from Chicago to Washington. D. C.

PERSONALS

Cooper, S. W., has been appointed assistant engineer, 4th Division, Alabama Highway Department, headquarters at Selma, Ala.

Hands, S. M., has resigned as city engineer of Iowa City, Ia., and has been made president of a quarry company.

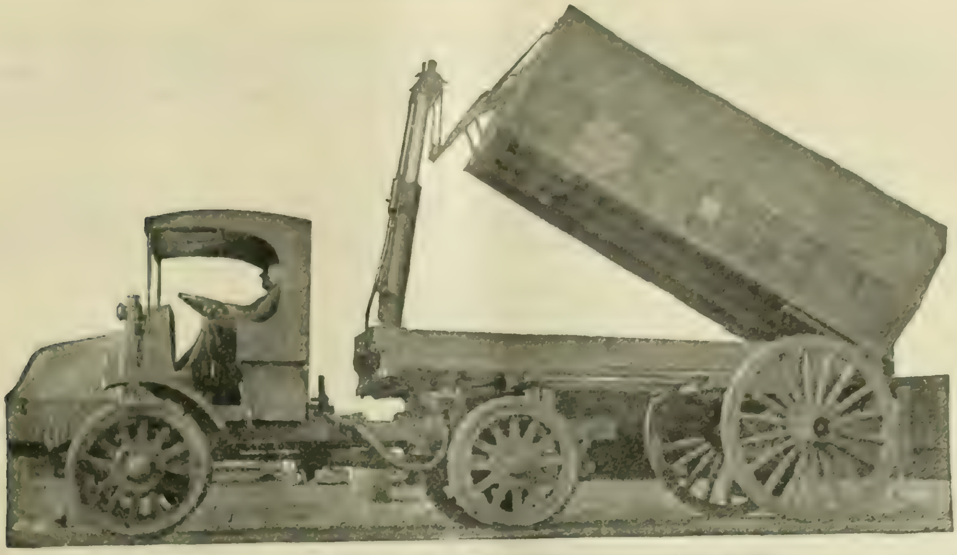
Bruce, J. A., has resigned as city engineer of Omaha, Neb., and has opened an engineering office.

Siteman & Cooper have opened engineering offices in the Federal Reserve Bank Building, St. Louis.

Powell, O. N., has been appointed engineer of Nueces county, Texas.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations



WALTER TRACTOR WITH AUTOMATIC DUMP BODY

THE WALTER TRACTOR—(Illus.)

The Walter four-wheel-drive tractor made by the Milwaukee Locomotive Manufacturing Company is designed to combine American practice with foreign military development for powerful and economical road hauling. Provision is made for applying power to each of the four wheels, a feature which enables the tractors to haul loads in mud, sand or snow, to surmount obstacles and climb steep grades impossible to other tractors.

The tractors have four forward speeds and one reverse. The stearing gear operates on all four wheels so as to make the rear wheels track and enables the tractor to make exceedingly short turns, running in a minimum circle of 26 feet diameter.

The powerful foot and hand brakes are of the contracting band type. The tractor is equipped with a powerful rear winch having 100 feet of ⅝-inch steel cable for pulling trailers in soft ground or on steep grade or for extricating the tractor itself from muddy or sandy places. The tractor has a draw bar pull of up to 5,000 pounds. The tractor is designed to be used as a truck or to haul trailers, and is equipped with a platform, a stake body, a special body built to specifications, or a dump body discharging either to the side or the rear.

When hauling four-wheel trailers, the tractor will easily pull 8-ton loads on dirt roads and 15-ton loads on pavements.

The motor is of the long-stroke, four-cylinder, four-cycle, water-cooled type, delivering 40 h. p. at low speed. The maximum speed of the engine is controlled by the governor with a motor speed of 1,000 revolutions per minute. The speed of the tractor varies from 2¼ to 12½ miles per hour.

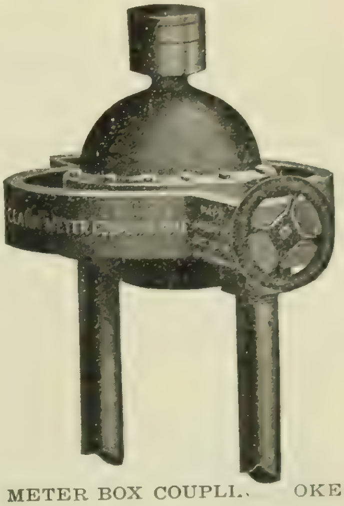
CLARK METER COUPLING YOKE

The Clark meter coupling yoke, manufactured by the H. W. Clark Company, can be set on any supply pipe without the use of unions, and is provided with a sliding adjustment which takes care of all strain from expansion and contraction in the pipe line.

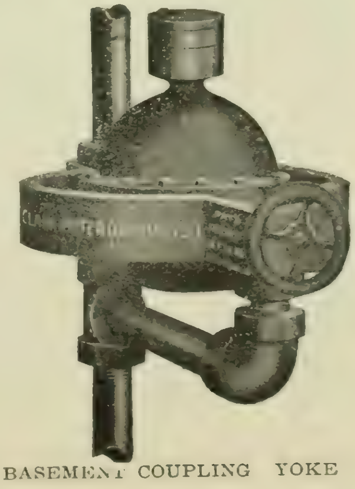
To install the yoke, the pipe is cut in two and both ends of the pipe are bent in opposite directions, threaded and ells screwed on. Risers are attached to the ells and the yoke is slipped on over slide block and the ells screwed on to the risers.

The yoke being kept transverse in the service line gives great flexibility to the latter.

In basement installations the entire vertical line is held rigid, the yoke and upper section being supported vertically by the lower section of the riser pipe with provisions through a sliding pin in slot for the adjusting movement of the yoke.



METER BOX COUPLING YOKE



BASEMENT COUPLING YOKE

American Steam Conveyor Corporation, Chicago, has changed its name to Conveyors Corporation of America.

PERSONALS

Neville, C. C., of the Construction Division of the United States army, was killed in the Wall street explosion, New York, September 16.

Leighton, George, one of the engineers of the Pennsylvania tunnels, New York, died at Glenburn, Pa., September 13.

Demeritt, H. L., United States Engineer, rivers and harbors service, died at Oakland, Cal., September 7.

New Catalogs of Interest to City and County Engineers, Superintendents of Water Works, Superintendents of Streets, Contractors and all Engaged in Public Works

If you want any of these Catalogs, write the number on a postal, sign your name and address plainly, and mail it to PUBLIC WORKS, 243 W. 39th St., New York. The Catalogs will be sent to you promptly without charge or obligation.

POWER TRANSMISSION MACHINERY

1. The A. & F. Brown Company, engineers, founders and machinists, Elizabethport, N. J. 5 x 8 inches, stiff covers, 129 pages and index. Lists gears, turned steel shafting, quill shafts, collars, split collars, compression couplings, band couplings, pin couplings, angle couplings, double angle couplings, clutch couplings, friction clutches, friction clutch pulleys, bronze bushings, pulleys of various kinds, pulley stands, coiling devices, shaft bearings, wall brackets, belt tighteners, rope sheaves, tension carriages, speed reducing devices, foot valves, mixers and grinders.

FERGUSON SEWAGE DISPOSAL SYSTEM

2. Ferguson Segment Block Company, St. Louis, Mo. 6 x 9 inches, illustrated, 9 pages. Description of design and operation of system with four sizes of installations intended to serve from one to thirty persons.

PRUDENTIAL STEEL BUILDINGS

3. Blaw-Knox Company, Pittsburgh. 7½ x 10½ inches, embossed covers, 32 pages, illustrated. List and description of standard sectional steel buildings for light manufacturing, housing, storage, hospitals, garages, shops and other purposes. Essential features, advantages, and dimensions and views of buildings used by U. S. Government and other important clients, drawings of plans, elevations and details and specifications governing designs and fabrication.

STEEL PIPE COUPLINGS

4. S. R. Dresser Manufacturing Company, Bradford, Pa. 7½ x 10 inches, 109 pages and index, illustrated, stiff covers. Policy of company, descriptions and illustrations of plant, lists, sizes, and engravings of bolts, caps, casing heads, couplings, clamps, crosses, ells, pipe fittings, gaskets, nipples, oil well supplies, saddles, screens and other articles.

TROY TRAILERS

5. The Troy Wagon Works Company, Troy, Ohio. 9 x 12 inches, 29 pages, illustrated. Descriptions, specifications and illustrations of four models of trailers of 1 to 5 tons capacity. Half-tones and descriptions of principal details of construction. Drop frame trailers, dump bodies and general and special equipment.

WALTER 4-WHEEL DRIVE TRACTOR

6. Publication No. 106. M[illegible] Locomotive Manufacturing Company, Milwaukee, Wis. 11 x 8½ inches, 20 pages, illustrated, stiff covers. Important features, designs and description of details, specifications.

MILWAUKEE GASOLINE LOCOMOTIVE

6. Milwaukee Locomotive Manufacturing Company, Milwaukee, Wis. Publication No. 118. 10 x 6¾ inches, 36 pages, illustrated, stiff covers. General description of designs, principles and important features of seven types of locomotives for standard and narrow gauge tracks. General specifications for different types.

THE LITTLE WONDER TILE DITCHER

7. Edward Jeschke, Bellevue, O. Folder describing and illustrating horse-drawn machine guaranteed to cut a ditch 10 to 14 inches wide and 30 inches deep. Testimonials from purchasers and records of efficiency.

LAND DREDGES

8. Bay City Dredge Works, Bay City, Mich., 10 x 6½ inches, 46 pages, illustrated. Description of important features of Bay City Land Dredges of the walking type, track type and floating type. Descriptions and illustrations of Bay City Gravel Loader and Bay City Clay Excavator. Illustrations of equipment installed and in operation for various purchasers.

ECONOMY EXCAVATOR

9. Economy Excavator Company, Iowa Falls, Iowa. 7 x 10¼ inches, illustrated, 24 pages in adjustable file cover. Descriptions, claims of efficiency and economy and advantages for operating in open work, for ditch cleaning and repairing, for road and railroad work, and for bank shoveling.

THE BLAW BULL DOG BUCKET

10. Blaw-Knox Company, Pittsburgh. Folder describing construction and showing details and dimensions of heavy excavating clamshell bucket.

REINFORCED CONCRETE PIPE

11. Independent Concrete Pipe Company, Indianapolis, Ind. Bulletin No. 9. 6 x 9 inches, 60 pages, illustrated. Description of pipes of standard diameter 24 to 90 inches for sewers, conduits, drainage, culverts and irrigation work, the pipes being cast at site according to design and with equipment and superintendent furnished by the pipe company. Half-tones of manufacture and installation of pipe and of pipe designs and of detail drawings.

SHUVELODER

12. The Superior Loader Company, Duluth, Minn. 6 x 9 inches, 50 pages, illustrated. Description of 4,300-pound machine 4 feet high, 4 feet wide and 6 feet long with capacity for loading 45 tons per hour handling rock, earth or ore to a height of 50 inches, with a bucket operated by power to scoop, lift and deliver as required. Driven by compressed air and operated by one man.

EVERYTHING FOR THE ROAD MAKER

13. The Good Roads Machinery Company, Incorporated, Kenneth Square, Penn. 10 x 7 inches, 64 pages, illustrated. Lists, describes and gives specifications for Little Winner, Big Winner, Giant Winner and National Hercules road graders, Champion road machines, scarifiers, road drags, wheel and drag scrapers, ploughs, rock crushers and portable bins, elevators and revolving screens, portable engine and boiler, winding drum and dump car, rock drill, gravel crushing and screening outfit, road rollers, road oiling machines and distributors, concrete mixers, pumps, car unloaders, street sweepers and sprinklers, culvert pipe and other supplies.

KOEHRING CONSTRUCTION MIXERS

14. Koehring Machine Company, Milwaukee, Wis. Catalog No. 22. 7¾ x 10¾ inches, 95 pages, illustrated, stiff covers. Important features of principle, construction and mechanical details of concrete mixer with notes of improvements and of advantages of different parts. Illustrations, specifications, and diagrams of different types and size machines; instruction for operating, bar cutting and bending machines, convenient tables of quantities of concrete in slabs and footings, material required per yard of concrete, weight, areas and circumferences of reinforcement bars.

GOOD ROADS FROM ROCKY FIELDS

15. United Iron Works, Incorporated, Kansas City, Mo. 10 x 6¾ inches, 22 pages, illustrated. Lists and descriptions of stone crushers and illustrations of stone crushing, cleaning, lowering and elevating the plant installed for road building. See catalog for full list of good road machinery.

BEST TRACKLAYER TRACTOR

16. C. L. Best Gas Traction Company, San Leandro, Cal. 7½ x 10½ inches, 32 pages illustrated, heavy paper, embossed covers. Description of history and development of an early gasoline tractor. Illustrations and descriptions of motor, oscillating truck, special features and mechanical details of the "60" tractor of 60 h. p. for hauling and general heavy duty work. Specifications. Illustrations of Cruiser and Swamp Special types.

PUBLIC WORKS.

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 49 FLORAL PARK, NOVEMBER 13, 1920 No. 20

Macadam Base for Bituminous Pavements*

The author discusses the factors affecting the strength and durability of pavements on macadam base, including strength of base, supporting power of the earth, and the traffic to be carried. He also calls attention to undesirable practices, especially insufficient protection of shoulders.

The following advantages have been claimed for the use of macadam as a foundation under asphalt pavements of various kinds:

1. Economy in utilizing existing macadam pavements.
2. Lower cost (depending upon available materials, labor rates, etc.) of construction of new macadam base as compared to Portland cement concrete.
3. Freedom from the transverse cracks that develop in bituminous surfaces on Portland cement concrete due to the contraction and cracking of that type of base.
4. Slight resiliency of the macadam base, which reduces the hammering or anvil effect produced upon an asphalt surface laid on unyielding base.

As an illustration of opinions from disinterested sources, a city engineer of a southern town states that bitulithic stays put on a macadam base very much better than on concrete; that a properly prepared macadam foundation is quite elastic, absorbing a considerable portion of the shock of heavy auto trucks and in throwing the entire burden of impact upon the wearing surface. Numerous similar views held by engineers could be cited.

In contrast to this viewpoint is the growing tendency in some localities to disregard the possible value of macadam road as a base, usually

DEEP SIDE DITCH AND VERY NARROW BERM
Danger of Breaking Down at Sides Under Truck Traffic in Periods of Wet Sub-Grade

PREPARED MACADAM BASE
Clean, Slightly Rough Surface, About 22 Feet Wide, for 18-Foot Asphalt Surface

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*Abstract of paper by Julius Adler, technical engineer, Atlantic Refining Company, before American Society for Municipal Improvements.

because it is considered inadequate under all year round heavy motor truck traffic. This opinion is supported by reports from a number of localities of serious damage to both macadam roads proper and macadam based types during the winter of 1919-1920. In view of the wide variations in climatic and other local conditions, in volume and weight of traffic, broad statements in regard to either the merit or lact of merit of such construction should be accepted with caution since success or failure in any particular case may be attributed to strictly local conditions.

To determine the limitations of a given type of paving construction it is necessary first to establish the factors affecting the strength and durability and, second, the application of these factors to a specific case. For the type under consideration, the factors are

1. Strength of base.
2. Variation in supporting power of the earth subgrade.
3. Volume and weight of traffic.

STRENGTH OF BASE

Under this heading come such elements as the total depth and degree of consolidation of the base, the size of the units used as aggregate, and the strength and durability of the aggregate.

Other things being equal, the greater the depth of base, the greater the area of sub-base over which the road is transmitted.

Consolidation refers to the thoroughness with which the pieces of aggregate have been forced into place during construction and by the action of traffic; it being generally conceded that traffic affects this more reliably than rolling alone.

Under size of aggregate units must be considered the relative value in the base of stone 1½ inches in diameter or less, ballast-size stone and large pieces such as used for Telford base, respectively. Results in general point very closely to the greater value of the base employing the largest possible size of aggregate, which affords greater stability, better distribution of loads, freer drainage and less disturbance by frost

Strength and durability refer to the quality of the aggregate material, whether soft, shaley, porous or dense and tough. It is generally well established that base material does not need to be so hard and tough as that in the wearing surface.

VARIATION IN SUPPORTING POWER OF THE EARTH SURFACE

This is a factor which causes the most serious damage. The supporting power is affected primarily by the character of the soil, natural and artificial provisions for drainage, and climatic conditions such as amount of rain and snow fall, depth of frost action and likelihood of alternate freezing and thawing.

Under the light traffic of years ago a macadam road developed a surprising beam strength, but with present truck traffic beam strength must be considered as nearly negligible and there must be reasonable assurance of nearly uniform support by the subgrade itself. On free draining soils, generally sandy or gravelly, very light macadam base has carried considerable traffic with entire success. Where natural drainage is poor, artificial drainage is absolutely essential. Everyone seems to realize this but comparatively few to carry out the ideas in practice. There will undoubtedly be some conditions such as heavy clay soil in flat sections subject to severe frost action where no prevailing method of drainage will give the subsoil sufficient strength.

Alternate freezing and thawing are especially detrimental. Numerous conditions can be cited where the temperature remains uniformly low enough in winter to keep the earth frozen continuously and prevent the percolation of water into the soil during this period, where the roads have stood up successfully. The critical time under such conditions is when the frost leaves the ground in the spring.

VOLUME AND WEIGHT OF TRAFFIC

For macadam base, probably the most important point in connection with traffic is that of the likelihood of the use of the road by heavy concentrated roads during the winter and the spring. In sections where traffic practically disappears through the winter and does not reappear in quantity until the subgrade is pretty well dried out in the spring, the damage by heavy traffic may be relatively slight. In general, the most severe damage is found in localities where heavy motor trucks use the roads throughout the year and especially during February, March and April.

SUGGESTIONS FOR IMPROVEMENTS

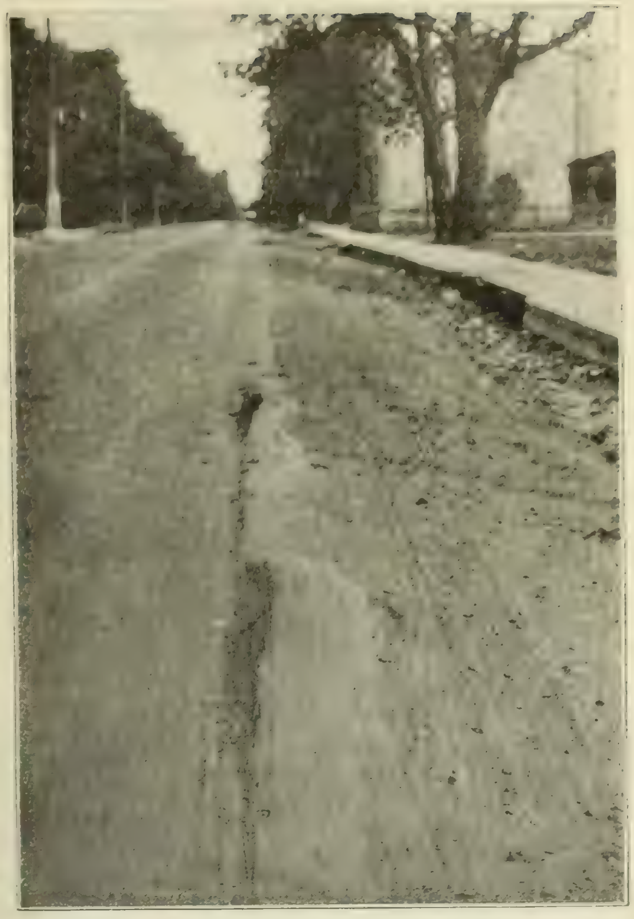
Assuming the above to be a correct analysis of the factors in the supporting power of macadam, the problem remains of applying these to individual cases and attempting to determine in advance which ones would be apt to shorten the life of the foundation and the overlying pavement.

Recent recommendations for this type of base vary from 4 to 12 inches depending on individual opinion as well as soil and drainage conditions. There has been a tendency to overestmate the depth of existing macadam arising largely from failure to realize that, while additional stone has been added year by year to the surface, an equal or even greater amount may be worn off meantime by traffic. Before using an old road, the depth at numerous points should be determined by test holes, which also will indicate the character of the existing aggregate. In general it is believed that where an old road contains 6 or 8 inches of compacted stone it is well worth saving. But no radical view should be adopted as to the minimum thickness of base that will support a proposed pavement. The writer believes however that 4 to 6 inches is not sufficient in the north eastern section of the country, especially near large cities. Even where ample depth is found, it is usually desirable to add a uniform layer of ballast-size aggregate, first scarifying the surface, the new aggregate serving to elevate the proposed bituminous pavement above the old base which, owing to the large amount of dust and fine materially usually contained, is very apt to hold considerable moisture at certain periods of the year. While this disturbs the top 2 or 3 inches of the old consolidated road, an old road which will not stand disturbance for this depth will generally not have depth adequate for use as a foundation in any case. Moreover, the greater regularity of contour of a base to which new aggregate has been added will add to the life of the bituminous pavement more than enough to offset the slightly more consolidated but irregular base which is apt to produce irregularity in the pavement surface. By admitting traffic under restrictions over the newly placed aggregate before applying the surface material, consolidation can be completed.

In utilizing existing macadam as a base, at least as much provision should be made for drainage as though an entirely new piece of road were being built. Too frequently this is not done, but shallow ditches, ditches too close to the improved surface, sections requiring special drainage, etc., are allowed to remain unimproved.

One type of failure of macadam base has been the squeezing out and breaking up of the sides due to a combination of too little lateral support at the shoulders, the softening of the subgrade under the edges of the pavement due to the entrance of water, and in general a failure to recognize that the sides of the road are thinner and weaker than the central portion. It is believed that the thoroughly consolidated base of full depth should always extend at least 18 to 24 inches beyond the edge of the pavement laid upon it. This will furnish much greater resistance to the thrust on the foundation from heavy loads travelling slowly on the sides of the road than is now encountered; provided, however, that the improved road is not so narrow that heavy traffic is constantly cutting off and on it.

As a further improvement, the shoulders should be water proof and support furnished at the edges of the bituminous pavement. Cases have been noted where the existence of an old macadam shoulder, even though rather thin, has been of material benefit. Well built stone block or rubble gutters and headers produce a similar result. If no better provision can be made, stone removed from the old surface can be used to harden the shoulders and additional aggregate brought in where required. One of the best practices for country roads is the construction of bituminous macadam wings three or more feet wide which provide water proofing and lateral support to the pavement and at the same time furnish a hardened surface capable of carrying occasional loads. At least there should be on each edge a strip of hardened surface 18 to 24 inches wide like the base previously referred to. This may be criticized as calling for a greater width of road and consequent cost than would be required if some other type of construction were used, but in its support it may be said that the change from the approved width of 15 feet of a few years ago to the present demand for 20 feet as being desirable, points unmistakably to the necessity for providing ample width at the outset. Also roads of other types built 16 to 18 feet wide will eventually need protecting wings for the preservation of the pavement, inasmuch as a sudden drop off from a hardened surface to a soft earth or clay shoulder is objectionable from several standpoints. If too close to the edge of a pavement, open ditches allow moisture to get under the base and reduce the support, while if far away, leaving a wide unwaterproofed shoulder, there is too much opportunity for the entrance of water through the surface, especially when it is heavily blanketed with snow or ice. For country roads a shoulder of about five or six feet wide is recommended, waterproof between the edge of the road and a point near the edge of the ditch.



EFFECT OF WEAK SHOULDER. CHIEFLY DUST
Lack of Support Permits Spreading of Pavement Under Heavy Truck Traffic

Missouri Highways

The Federal Road Council of St. Louis has a plan for the construction of 43 miles of 20 feet wide hard-surface roads in Missouri as soon as materials are available. The secretary and manager of the council urges support for the proposed $60,000,000 state road bond issue that is to be voted on in the November election and explains that if this sum is secured it is intended to build 6,000 miles of hard roadways in Missouri immediately and that it is planned to accomplish this without direct taxation by providing for it from state fees for automobile license.

Specifications for Broken Stone Foundations

The latest approved methods of building new macadam base or utilizing old for bituminous surfaces given in the form of specifications by a committee of the American Society for Municipal Improvements.

These specifications were prepared by Linn White, chief engineer, Chicago South Park Commission, and a member of the Committee on Foundations for Pavements of the American Society for Municipal Improvements, and was presented at the St. Louis convention of that society as a progress report of the committee.

SUB-GRADE

In the case of the construction of new broken-stone foundations for pavements the sub-grade shall be prepared by cutting or filling as may be required to produce a surface parallel with the finished grade of the wearing surface and a distance below the finished grade equal to the specified thickness of the foundation and paving material.

The sub-grade shall be brought to a firm, unyielding surface by rolling the entire area with a three-wheel road-roller weighing at least ten tons, and all portions of the surface of the sub-grade which are inaccessible to the roller shall be thoroughly tamped with a hand tamper weighing not less than forty pounds, the face of which shall not exceed eighty (80) square inches in area. All soft, spongy, or yielding spots and all perishable matter shall be entirely removed and the space filled with suitable material.

When considered necessary or of assistance in producing a compact, solid surface the sub-grade before being rolled shall be sprinkled with water.

SUB-DRAINAGE

When the soil is of such a character that it retains an excessive amount of moisture, such as clay subject to swelling or heaving under the action of frost, or sands similar to quicksand that do not afford a ready natural drainage, sub-drains should be provided.

These may be of two general kinds, first, tile drains of open porous material or vitrified tile laid with open joints; second, trenches filled with broken stone, gravel, cinders or other similar material.

In some cases it may be sufficient to construct a sub-drain on each side of the roadway at or near the lines of the gutters, but when the soil is of a very wet nature, it may be advisable to lay additional lines of drains which may be in or near the middle of the roadway. This system of drains may be varied by diagonal lines of drains running from near the crown of the roadway to the gutters.

In all cases the drains should have connections with the existing sewers, catch basins or inlets.

NEW MACADAM FOUNDATION

If the pavement is to be laid on a new macadam foundation, the macadam shall be built as follows:

The total thickness of the macadam base will vary according to character of soil, drainage, kind of stone available, etc. In general the macadam base should be constructed of broken stone which is sound, hard and durable under traffic. The broken stone should be separated into different sizes by screening, the smaller sizes with the dust being used to fill and bond together the larger sizes. The thickness of the base should be regulated by experience in constructing ordinary water-bound macadam roads in similar situations, the total thickness of base being made the same or a little less than well-constructed macadam.

After the sub-grade has been properly prepared, spread a layer of clean stone passing a three (3) to three and one-half (3½)-inch revolving screen and held on a two (2)-inch screen to a depth sufficient when thoroughly rolled to form about two-thirds (⅔) of the total thickness of the base. The thickness of this layer should be regulated by laying on the sub-grade at proper intervals cubical blocks of wood of the proper dimensions to give the desired thickness or regulated by other means approved by the engineer. Over this layer of stone, spread with shovels stone screenings in sufficient quantity to fill the voids between the larger stone. The screenings should be spread gradually, and be thoroughly rolled with a road roller weighing at least ten (10) tons during the process of spreading the screenings. As the screenings are worked into the coarse stone under the roller, more should be added here and there where voids appear. At first the rolling should be done dry (working from the edges towards the center of the roadway), until the stone appears to be well filled, then the surface should be well sprinkled and again rolled, the rolling and sprinkling continuing until the layer of stone is thoroughly compacted and no more screenings can be worked in. Just enough screenings shall be used to fill and bond the stone, leaving no surplus screenings on the top.

The above method may be varied by using the crusher-run of stone without the addition of any other filler where the small sizes are not in excess. Also a filler other than stone screenings, such as bank gravel or sand may be used in some cases where experience with the materials available shows that better results can be obtained. Under some conditions, the character of soil and stone available may be such as not to require the use of any filler with the stone of the first course. The specifications given, however, represent the best average practice where stone with bonding value, such as limestone or trap rock, can be obtained.

When the first layer of macadam is completed as specified, spread a second layer of clean stone passing a two (2)- or two and one-half (2½)-inch screen and held on a one (1)-inch screen to a depth sufficient when thoroughly rolled to form the remaining one-third (⅓) of the total thickness of the base. Over this layer of stone spread evenly with shovels stone screenings and roll with the application of water by sprinkling until the layer of stone is well filled, well bonded and firmly set in place. In the case of bituminous pavements just enough filler should be used to accomplish this purpose and not enough to form a layer or film over the surface of the stone. In fact, it is better not to fill the stone quite flush, leaving the coarse particles of stone slightly projecting, so as to have a coarse, grainy base upon which to put the wearing surface. In the case of block or brick pavements, enough screenings should be used to produce a smooth, evenly filled surface.

The thickness of the base should vary according to local conditions and should be fixed by the engineer in charge when all the varying conditions of soil, drainage, traffic and materials of construction are understood. In general, a thickness of macadam base of eight inches will be enough for any except the most adverse conditions, and a base of four to four and one-half inches will meet the most favorable conditions of firm, unyielding soils and light traffic.

OLD MACADAM FOUNDATION

If the pavement is to be laid on an old macadam base, the surface should be thoroughly swept and cleaned of all fine material that may be caked upon the surface of the stone or lying loose as dust, thereby exposing the clean coarse stone for the reception of the bituminous concrete.

If the old macadam does not present the desired coarse, grainy surface, or is not at proper and satisfactory grade after cleaning, it shall be spiked up and redressed to the desired crown and grade, the coarse stone being brought to the top by harrowing or otherwise, or new stone added when, in the opinion of the engineer in charge, it is needed to give the necessary thickness or character of surface. It shall then be thoroughly rolled with the use of water as may be required.

In the case of bituminous pavements a layer about one stone deep of new, clean stone, averaging one and a half (1½) inches in size, shall be spread over the surface after redressing and rolling the old macadam, and finally rolled until firmly set in place without the application of water. This is intended to form a coarse, grainy surface of fresh clean stone which will bond with the bituminous paving material.

Discussion of Macadam Base For Bituminous Pavement

In discussing the two previous papers, Mr. Warren suggests seven rules for planning the use of old macadam.

The following is an abstract of a written discussion on this subject presented at the convention of the American Society for Municipal Improvements by George C. Warren, president of Warren Brothers Company. Mr. Warren has for ten years urged and successfully practiced the use of old macadam roads as a foundation for bituminous surfaces, but realizes the limitations. The macadam must be real macadam of stone or gravel and of substantial strength and depth or must be reinforced with new stone compressed into it. It should not be tried with a pavement composed of a small percentage of stone or gravel in a large percentage of clay or other weak material nor with a veneer of indifferently spread stone on a weak subsoil. On the other hand, in nearly all cases where any stone or gravel has been spread and compressed on the subgrade.

RESULT OF POOR DRAINAGE—ASPHALT BLOCK PAVEMENT ON SIX-INCH CONCRETE BASE
The Trouble Was Not Due to Either Wearing Surface or Base, But to Insufficient Drainage. Note That the Road Bed is Several Inches Below the Adjoining Property

there is at least a great salvage value which should be conserved.

In city streets, especially those having street railroads, it is sometimes necessary to remove some of the old macadam to prevent raising the gutters too high at the curb or the pavement too high next to the railroad track. This will not often be the case however, if the engineer does not attempt to provide an exposed face of curb higher than is necessary. In some cases a few additional catch-basins may be necessary to reduce the flow of surface water in the gutter, but that can be provided at only a fraction of the cost necessary to remove the old macadam as a whole or in part. In constructing country roads, the raising of the elevation of the pavement is advantageous rather than detrimental.

For planning this use of macadam he suggested a few rules:

1. Never depend on surface appearance nor even on test excavations made a few weeks or months before construction to determine whether or not the old macadam will require reinforcement.

2. Make test holes (or better, test cuts across the street or road) at intervals of about 100 feet immediately in advance of construction and from these determine the necessity for new metal to provide the necessary strength of base, which will doubtless vary on different sections of the same project. The quantity cannot be definitely determined in advance and consequently should be paid for by the ton or cubic yard of new material actually used, and bids asked on that basis.

3. Do not disturb the old macadam by change of grade or contour or by scarifying unless absolutely necessary. Any disturbance more or less reduces the strength and consequently the conservation value of the old macadam and sometimes actually removes practically all of it in the center of the road. If the crown is excessively high, better correct by building up the quarters and outer edges with new metal than to remove solid road metal from the center, unless there is a greater depth of solid macadam in the center than is necessary.

4. However thin or weak the road metal on the street, it is better to leave it and use it for all it is worth than to remove it.

5. If test excavations develop 6 inches or more of solid metal (whether gravel or crushed stone) in which the coarse particles from ¼ inch to 2 inches constitute more than one-half the total metal so that the finer particles merely fill the voids, then no treatment is necessary-or advisable except to regulate the grade, knocking off the high points and filling in the low places by scarifying, using picks in the roller wheels, or hand picks, whichever may be most economical in each case, and then thoroughly roll.

6. If the test excavations show that the fine particles predominate or the depth is insufficient on the whole or any part of the street, that condition does not justify removing the material, but after regulating the grade add whatever depth of new metal intelligent consideration of all the conditions indicates as best and safe.

7. If drainage is poor, correct it. Depth and rigidity of base do not correct faulty drainage. On the other hand faulty drainage can be corrected at much lower cost than by destroying old macadam and furnishing new base. Failure to provide drainage is the prime cause of many failures of macadam pavements. The disaster during the past spring thaws was not at all confined to roads with foundations of the macadam type nor to any special type of surface. The trouble was universal throughout New England, New York and elsewhere at places where drainage had been ignored or was faulty. The accompanying illustration of a block pavement surface on Portland cement concrete base illustrates this point. No one who examined this would fairly charge the destruction to type of either surface or base. It was simply faulty drainage. This road is several inches below the abutting land—a condition itself which always invites drainage disaster, as it provides no outlet for surface drainage except to seep under the road. During the spring of 1920 Mr. Warren examined a road which had exploded for a length of about a mile. It was in a rolling country and the middle of the damaged section was at the intersection of two long grades ascending in both directions, with no provision for drainage. One week's thaw in that mile caused $20,000 damage. Not only was there no sub-surface drainage, but a telephone conduit had been laid in the street without even installing lateral drains or weep holes, and during the thaw the conduit became filled with water from the sub-surface which overflowed through the manholes.

While the writer had had no experience with using macadam base for a block pavement, he advised against it until it had been tested for several years under varying conditions. He feared that the irregularities of surface would prove disastrous; the blocks certainly could not be laid directly on the macadam, and if laid on a cushion of Portland cement over the macadam, the thin cushion would probably be broken up by the traffic. A sand cushion would be more or less irregular in depth and would probably cause the blocks to rock and settle unequally under traffic.

As showing the durability of bituminous surface macadam base, the writer cited the example of Commonwealth avenue, Boston, which was surfaced in 1916 with bitulithic laid over the old macadam without any new metal. Traffic record for twelve hours on Saturday, October 20, of this year, gave 13,316 vehicles and the following Tuesday, 14,120 vehicles No repairs had been made since the pavement was laid and the present contour and surface are in perfect condition.

Concerning Major Compton's suggested specifications, the writer believes that adding a layer of crushed stone on an old macadam "to form a coarse, grainy surface of fresh, clean stone which will bond with the bituminous paving material" is quite unnecessary, and that new metal should be added only where required to give depth and solidly to the old macadam.

Studies of Flood Discharge of Pine Creek*

In planning for increasing the water supply of Paris, Texas, unusually complete studies were made of the run-off of the catchment area. The designing of the spillway was considered the most important problem, the peak discharge being very high.

By John B. Hawley

During the summer of 1920, the writer studied the water situation of Paris, Texas, looking toward an increased supply.

Although both "Woodbine" and "Trinity-Paluxy" (Antlers formation) sands underlie the city, the former at 400 to 1,200 feet and the latter at 1,900 to 2,700 feet, neither gives artesian flow. The Woodbine water is quite highly mineralized; Trinity-Paluxy is very deep.

Preliminary studies resulted in favor of surface storage.

Pine creek and Sander's creek, tributaries of Red river, were both carefully surveyed. Their

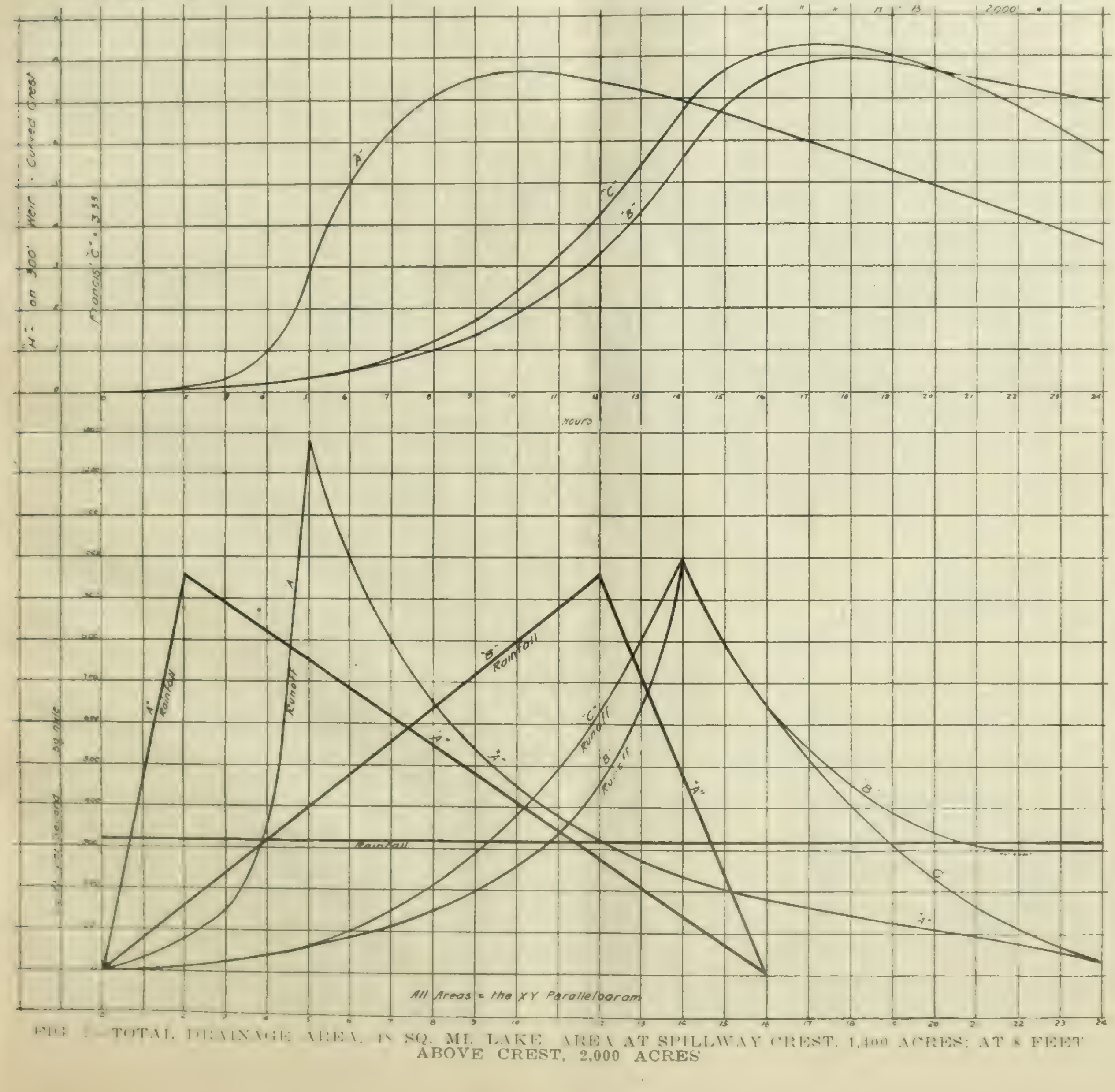


FIG. 1.—TOTAL DRAINAGE AREA, 18 SQ. MI. LAKE AREA AT SPILLWAY CREST, 1,400 ACRES; AT 8 FEET ABOVE CREST, 2,000 ACRES

drainage areas lie northwesterly from Paris, and are wholly in the "Eagle Ford" shales. Rainfall records for thirty years are available, but no stream discharge records were found, and observations were made on the very high flood discharges of May, 1920.

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*Paper before the Texas Section, American Society of Civil Engineers.

Toward the end of the investigation Daniel W. Mead was called into consultation, joining the writer in reporting favorably on Pine creek as the best source of increased supply for the city.

Spillway design appealed to both investigators as the most interesting and difficult problem involved in the research. Tentatively, a concrete spillway, 400-foot width and 8-foot depth of overflow on crest, was included in the estimates, with the statement that more detailed studies would probably reduce the width. The diagrams given indicate 300 feet as the probable safe dimension.

Pine creek, above the selected dam site, has a drainage of 48 square miles, approximately 60 per cent in cultivation. The axial slope of the valley is about 7 feet to the mile; height of divide about 100 feet above dam site, width about 3½ to 4 miles. Soil, detritus of the Eagle Ford clays and shales. (Within the drainage area, the city maintains a lake for water supply purposes, whose drainage area is about four square miles. Lake surface, 220 acres. Capacity, 1,000,000,000 gallons. In the computations below, no account was taken of this lake.) Altitude of the area, about 600 feet above sea level. Area of proposed Pine creek lake, 1,400 acres at spillway level; 2,000 acres at 8-foot depth on spillway. Capacity, about 4,000,000,000 gallons.

Paris lies in the quadrangle bounded by the 95th and 97th meridians, and the 33rd and 35th parallels of latitude. Data published by A. E. Morgan, chief engineer of the Miami Conservation District, shows this quadrangle to have had, at some time, a 24-hour precipitation of 13.3 inches; two days, 14.2 inches; and three days, 14.6 inches. (Hydrology. D. W. Mead, 1919, p. 272.) The rainfall of May 12, 1920, was 4.54 inches at Paris.

Eagle Ford soils, after the early wetting of a driving rain, become "slick" and impervious to a high degree. Thereafter so large a percentage of the downpour runs off that, in the case of the recorded 13.3-inch 24-hour rainfall, the writer has assumed 12 inches of run-off. Similarly, in the case of the 4.54-inch rainfall of May 12, 1920, Mr. Mead assumed practically 100 per cent run-off.

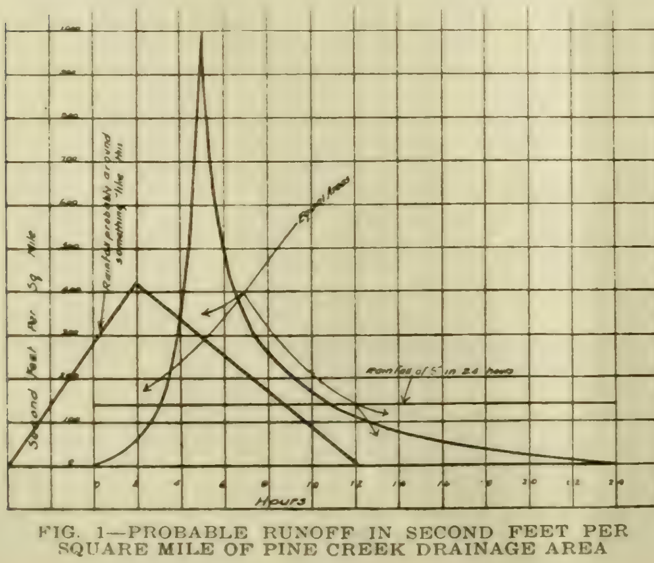


FIG. 1—PROBABLE RUNOFF IN SECOND FEET PER SQUARE MILE OF PINE CREEK DRAINAGE AREA

Mr. Mead's analysis of hourly distribution of a 5-inch 24-hour rainfall, and resultant peak flood discharge, is illustrated in Figure 1.

Figure 2 gives the writer's analysis of probable hourly (alternative) distribution of the maximum recorded 24-hour precipitation, with three assumed curves of flood discharge, together with depths on a 300-foot crest with properly designed vertical curves.

Study of Gardner S. William's work on dam crests indicates that the co-efficient "c" in Francis' formula would increase from about 3 to 3.9, but for the purpose of these analyses, and to be ultra-conservative, "c" is assumed at 3.33 throughout.

The writer has failed to develop a formula or set of formulas which would cover the determination of crest depth (lake level), based on inflow of storm water, retention of volume due to expanding storage capacity of the lake, and the discharge capacity of spillway. Several constants were, of course, developed and utilized, but in the main, the computations were by the trial method, gradually approaching exactness. (The writer estimates that probable error is less than 0.1 foot of elevation at each hourly point.)

It is not only possible, but wholly probable, that any one of an infinite number of distribution and run-off curves might be laid for the precipitation analyzed in Figure 2, yet the assumptions used are deemed by the writer to fairly cover the case.

Col. F. W. Scheidenhelm, in his paper on "Reconstruction of the Stony River Dam," Transactions American Society of Civil Engineers, Vol. LXXXI (1917), cites peak flood discharge of the 22-square-mile Cave creek, Bakersville, N. C., drainage area at 1,386 second feet, and the 44-square-mile Elkhorn creek, W. Va., drainage area at 1,363 second feet per square mile. Based on these and other data, and his own observations, Col. Scheidenhelm estimates a peak flood discharge for the 11.4 square miles of the Stony river drainage area to be 1,840 second feet per square mile.

Inasmuch as the Stony river, Cave creek and Elkhorn creek areas all lie more than 3,300 feet above sea level, and in rugged mountainous country, the writer feels that the peak flood discharge of 1,280 second feet per square mile for Pine creek drainage area, with its easy slopes and 600-foot altitude, is reasonably conservative.

The "smoothing" effect of sizeable lakes on peak flood discharge is well illustrated in this analysis. If it be true that the peak in this case is 1,280 second feet, the 48 square miles would give a peak of 61,440 second feet. Figure 2 shows a maximum weir crest depth of 8.32 feet, with discharge of

23,900 second feet. Construction of the dam will doubtless save the "Frisco" Railway trestle and county highway bridge, below the site, the washouts they have frequently experienced.

Lake Worth, from which Fort Worth draws its water supply, has a masonry spillway 700 feet wide, capable of safely carrying a depth of 10 feet. Drainage area, 2,000 square miles, partly hilly and uncultivated. Lake area (at 6½ feet depth on spillway), 5,500 acres. Greatest observed depth on crest of spillway (1914 to 1920), 6.5 feet. Maximum discharge, 40,000 second feet, or 20 second feet per square mile. Average rainfall, 28 inches. Maximum rainfall, 48 inches. This in comparison with Paris' rainfall average, 37 inches; maximum, 60 inches.

Paris and Fort Worth are but 140 miles apart, geographically. Maximum yearly rainfall at Paris is but 25 per cent greater than at Fort Worth. Parts of the Trinity drainage area (Lake Worth) are mountainous compared with that of Pine creek. Multiply the Lake Worth discharge by, say three, in order to arrive at a possible peak flood discharge per square mile, 60 second feet. The Pine creek (probable) peak discharge is 1,280 second feet, twenty-one times as great. Verily, it behooveth the Texas engineer to take thought in spillway design. Beware of small drainage areas with cloudburst proclivities.

Air Pockets and Vacuum Troubles in Gravity Water Mains*

By J. W. Ledoux †

The author describes how such pockets may diminish or entirely stop the flow of water in pipes of irregular profile. Also how best to fill a gravity system.

Nearly every water works superintendent has experienced trouble in connection with some phase of air in pipes. A leaky suction pipe often reduces the plant efficiency materially and sometimes results in serious damage to the pumping machinery.

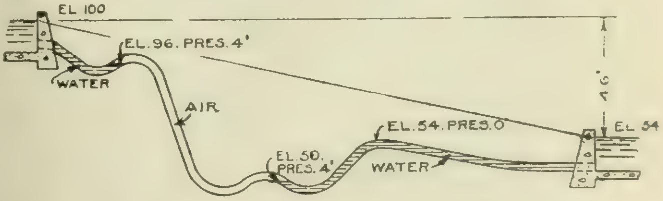
Where the discharge pipe is perfectly tight, if a small quantity of air be pumped with the water, it is likely to accumulate in the summits and appreciably reduce the capacity of the pumping main, or—what is the same thing—increase the frictional head due to the reduced cross-section of the pipe at the summits. The remedy is to prevent the ingress of air at the pumping plant, but even at the best more or less air is entrained with the water, and under reduced pressure at the summits this air may at times accumulate, and then the only remedy is to provide automatic air valves on these summits. However, this difficulty is not common for several reasons. Unless it enters the pumping main in large quantities, it is generally carried along with the water; and if an air obstruction develops, the automatically increased pumping pressure tends to drive it over the summits by attrition. Also, air will escape through apertures too small to show water leaks, and there are usually enough of these to prevent noticeable trouble from pumping discharge mains. This property of air is often the cause of leaks, for in discharging at a high velocity it increases the size of the aperture by washing out fine particles of material that would remain in place if the pipe were full of water.

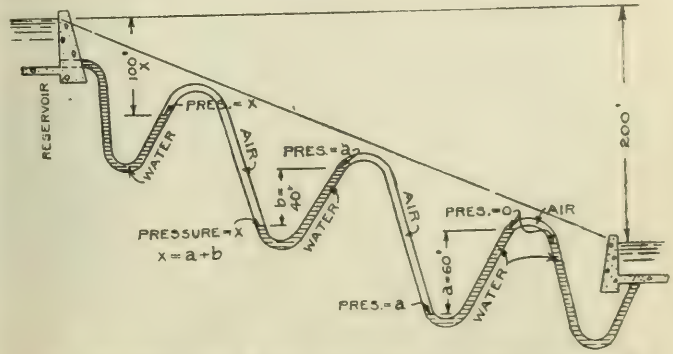
While the cushioning effect of air in mains often prevents serious water hammer, on the other hand its sudden escape at a high velocity, as sometimes happens, will produce serious water hammer.

The accumulation of air in summits of gravity mains has frequently resulted in the complete interruption of the supply on large portions of the system, and sometimes this phenomenon is troublesome and difficult of correction.

In one case in the experience of the writer a 14-in. main extended from a distributing reservoir, at elevation 628, across a valley, the elevation of which was 150, to the opposite hill at elevation 550, where there was a considerable amount of population, and very variable topography. Branches from this main extended at right angles in both directions to lower elevations. It was found that no water could be furnished on one of these branches, as was evidenced by the complaints of the consumers. The spigots were opened in houses and the water would not flow even at the ground floor. After many hours of investigation, a pocket of air under pressure was discovered at one of the summits, and as soon as this was released the supply was immediately resumed.

Another case consisted of a 16-in. gravity main





NO WATER FLOWING—SYSTEM IN CONDITION OF STATIC EQUILIBRIUM extending for eight miles from an impounding reservoir to two standpipes supplying a railroad service. It was found one afternoon that no water would flow into the standpipes, and it was immediately assumed that somebody had closed a valve or that the reservoir was empty, because there had not been experienced any trouble since the line was installed several months previously. An inspection was made; air valves were opened all along the mountain at the various summits; no water flowed and no air came out of the main. It was finally learned that on the day before a valve had been closed near the reservoir to make some slight repair on the line; on inquiry it was found that this valve had been reopened and this was verified. It had been the intention to locate automatic air valves at all the summits. One of these summits was close to the impounding reservoir. Finally this air valve was examined and to the surprise of everyone it was found disconnected and lying in the valve pit. On opening the air valve connection, the air escaped and the water began to flow freely. This particular summit was so close to the reservoir and so small as compared with the others on the line that no one suspected that trouble existed at that point

---

* Paper read at recent annual convention of New England Water Works Association.

† Consulting Engineer, Philadelphia, Pa.

The accompanying diagram illustrates the principle. In this case the impounding reservoir is shown 200 feet above the distributing reservoir, and under these conditions no water can flow through the line until the air is relieved at the summits.

The upper figure illustrates conditions that occurred in the gravity supply to the railroad tanks.

The above examples show conditions of static equilibrium and a balance which is frequently very delicate. This condition is not likely to take place wth pumping mains, where the pressures fluctuate, but is characteristic of fixed levels of water as occur in gravity mains. At least, that has been the experience of the writer.

One of the most important conditions where serious damage can be caused on a pipe line is in the case of a large wood or steel pipe laid over summits and valleys. If, due to water hammer or defect in the pipe, an actual split or break of the pipe takes place in the valley, permitting a large quantity of water to discharge faster than the water can pass over the summit to keep the pipe full, a partial vacuum occurs, and unless the pipe is designed to resist it, collapse will take place. The only remedy for this danger is to maintain a sufficient number of poppet valves designed to take large quantities of air into the line automatically; some very serious damage has taken place due to the absence or insufficient size of these automatic poppet valves.

A vacuum is sometimes caused in a pipe line for another reason. Let us suppose a large wood or steel pipe line extends from a distributing reservoir down the hillside to a flat 200 feet below, and that the pipe line is full of water but not flowing. Now, if between the base of the hill and the distributing reservoir, a valve be shut, the pressure at the downstream side of the valve will at once drop to almost a complete vacuum, because this part of the pipe line is relieved of the atmosphere pressure, acting on the distributing reservoir. Under these conditions collapse of the pipe is likely to take place.

In connection with this subject, it may be well to call attention to the best method of filling a gravity piping system that has been emptied for any reason. The writer has heard many experienced water works men advocate filling the pipe line by sections. This is a very bad practice. The best method is to open air valves at all the summits and open the blow-off valves in all the hollows and a sufficient number of hydrants in the town. Then the valve at the impounding reservoir is opened a sufficient amount to fill the line in a predetermined time. As soon as the water appears at the first blow-off and flows full, this is shut, and as soon as it flows full at the second blow-off, that is also shut, and so on until the water appears at the city hydrants, shutting the low ones first and following them up until the high ones are shut; finally, the air valves on the line are closed and the line is in service, and no danger of water hammer has been experienced, and the line is filled in a shorter time than can be done by any other method.

Water Pipes Distributed by Tractor

Within the past two years the city of Detroit has laid a large amount of water-mains from 8 inches in diameter upward in outlying districts, many of them where the ground was low and wet and the street unpaved, making hauling very difficult in wet weather.

Under these conditions, the pipe is hauled as far as possible on trucks, then unloaded, piled in bundles, and dragged to the required locality and distributed by a Holt caterpillar tractor with a two-man crew. The same tractor has also been frequently of service in hauling truck loads of pipe out of bad sections of road where they had become stalled.

TRACTOR HAULING WATER PIPES WHERE ROADS ARE TOO BAD FOR TRUCKS TO DELIVER HEAVY LOADS

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Trade Unionism in Engineering

Trade unionism as now practiced, and engineering conducted according to the ethics of the profession, cannot mix, and certain societies would seem to be justified in the stand which they have taken or are contemplating of refusing membership to those who are members of a trade union.

The Building Trades Council of Newark, N. J., last month made a demand that all plans for buildings and structures constructed in that city must be prepared by members of the "Engineers', Architects' and Draftsmen's Union," this to take effect November 1st, after which date union labor in that city would do no work on new buildings or structures not so planned.

Such action appears to be almost absurd in its presumption, and yet appears to have been taken seriously by the trades council. It is stated that there are practically no draftemen in the architects' offices of Newark who have joined or are favorable to joining this union. How many will be frightened into joining it by this action remains to be seen, but it is to be hoped that the result will be exactly contrary to such expectations, and that any engineer or achitect who is now a member of such union will immediately resign therefrom as a protest against such action.

The American Association of Engineers has sometimes been referred to (against its protest) as an engineers' union, but its stand on such action as this is indicated by the resolution adopted by it on May 11th, "that the advocacy by any member of the A.A.E. of strikes or other questionable methods commonly employed by labor unions to secure their ends shall be considered a sufficient ground for his expulsion." This was not a statement of a new policy, for during the previous year the directors and past officers made a statement defining the position of the society, certain clauses of which are as follows:

> Production should be increased—not limited. The profession cannot support strikes or lockouts or any other methods that may benefit any class at the expense of the nation as a whole.
>
> The engineer, as an educated professional man, believes in basing his claims for proper and just reward for his services upon the justice of the facts presented, upon enlightenment of public opinion, upon loyalty between employer and employee, and upon the underlying fundamental desire of the great majority to do what is fair and right when the merits of the case in question are clearly presented and demonstrated. We believe in organized representation for the correction of wrong, the advancement of the profession and service to the public, but are opposed to methods inconsistent with the dignity of the profession and which would lessen public confidence.
>
> The A. A. E., recognizing the many fundamental differences between the principles and objectives of the trade union and of an organization of professional men, expresses the opinion that an engineer cannot subscribe to the tenets of both.

The engineering profession will indeed be in a sad way, and the public works of this country in an even sadder one, when the choice of an engineer for designing such works, even the most important ones, is based not upon the experience, technical knowledge, wisdom and skill of the engineer but upon whether he is a member of a union. It does not seem to us conceivable that the leading engineers would ever be driven to union membership by any such action as that of the Newark Building Trades Council.. And it does not seem possible that the officials in the city government would dare to spend the hundreds of thousands yearly devoted to the construction of such works if they must rely for their designing and supervision upon such so-called architects and engineers as may have possessed themselves of union cards.

It may have been that some of the younger members of these professions have joined the union because they fear that they cannot otherwise receive due consideration of their claims. However true this may have been in the past, it is so no longer. The American Association of Engineers has proved its ability to serve these young men fully as effectively as a union and without violating ethics of the engineering profession; while numerous other engineering societies, such as the American Society for Municipal Improvements (reference to its recent action is made in this issue) and the Brooklyn Engineers Club, have instituted practical efforts to welcome, encourage and benefit the younger members of the profession.

We hope that every engineer and architect, young or old, will protest against any such effort to unionize the profession as that here related by refusing to in any way recognize any such absurd and insolent demands upon the profession by any union or organization adopting union methods.

A Loyal Engineer Corps

Sonoma County, California, is to be envied and congratulated on the character of its engineer corps and on their sturdy integrity in refusing to participate in or submit to political interference with their public duties. When the county engineer was defeated by political opposition, the entire staff of 41 men resigned as a unit and in a formal protest expressed complete confidence in the engineer and refused to work under a policy opposed to him and inimical to public welfare.

This action demonstrates the character of the men who had the courage of their convictions even to the point of refusing salaried positions which are difficult to replace quickly and is convincing proof of the ability and integrity of their chief who has been able to collect such a staff and imbue them with high ideals and practical patriotism.

Their action, directed in opposition to their own immediate welfare, for the benefit of the county and fair dealing is the strongest possible rebuke for political meddling in technical matters. If the people of Sonoma county do not recognize this and take measures to immediately reinstate their engineer and his faithful staff, they deserve the poor work and extra cost that they may be assured will follow the displacement of such men, and the men themselves will not lack recognition and appreciation from the engineering profession and from broad minded officials who will learn of this action and will doubtless hasten to secure such unusually dependable men for their service on appreciative terms.

There are many such men with high ideals in all ranks of the engineering profession and such loyal action would oftener be noticed if the chief engineers themselves, after arriving by a long and laborious progress at their positions of responsibility, would always have the courage to resign or vigourously combat the evils and injustices that politicians and grafters often try to impose on them. Some would doubtless lose their positions at first, but the public would soon uphold them when conditions were fully explained and men of militant integrity would find themselves at a premium for many private and corporate positions.

Staff Resigns on Chief's Defeat

Lloyd Aldrich, county engineer of Sonoma county, Cal., was defeated at the election on August 31, owing to the attitude of public officials and politicians and the lack of support of the people of the county.

The engineer's staff, numbering 41 engineers, has resigned in a body as a protest against the treatment accorded to Mr. Aldrich, giving out the following reason:

> Resolved, That we, the engineering organization of Lloyd Aldrich, county engineer of Sonoma county, do hereby express our great confidence in the ability and integrity of our chief, and our refusal to subordinate ourselves to authority governed by ideas which we believe are not in accord with the public welfare and the best engineering practice, by making our resignation from the service of Sonoma county coincident with his own.

Atlantic City Garbage Disposal

Following the refusal of the previous contractor for garbage collecting and disposing of Atlantic City's garbage to carry out his contract, the city commissioners recently asked for bids for performing this work for one, three and five years. Only one bid was submitted on October 28 and this was tendered by a newly organized company which proposed to use the plant constructed by the Farmers' Product and Supply Company which had formerly held the contract. The latter company's contract was for $195,000 for five years, while the bid recently submitted was for $190,000 for one year, $495,000 for three years or $750,000 for five years. The city is now paying at the rate of $123,000 a year for the collection of the garbage until a regular contract can be entered into.

The company which bid, the Island Fertilizer Company, claimed that it had lost $190,000 during the two years and seven months that it had operated under the old contract, and that prices had advanced so that its loss would have been at least $400,000 had it carried out its contract to the end of its term; coal, for instance, costing nearly four times as much now as then and being used at the plant at the rate of 4,000 tons a year. On the other hand, a year ago the company was getting 11 cents a pound for grease and to-day was receiving but 6 cents, this drop being attributed to the importing of great quantities of vegetable oils from Japan and the south.

Action on the bid was postponed to November 11. Several of the commissioners considered the bid entirely too high, and there was some consideration of municipal ownership of a plant.

Construction Hearings

The Senate Committee on Reconstruction and Production known as the Calder Committee, has just left New York for a trip through the Central West and South during November.

Hearings will be held at Kansas City, November 17; St. Louis, 18; New Orleans, 20; Birmingham, 22; New York City 24th.

The following contractors have been asked to testify on existing conditions from the standpoint of the general contractor, offering constructive criticism for remedying conditions which should be changed: James R. Gloyd, Cleveland; W. A. Rogers, Chicago; Fred R. Weitz, Des Moines; Edward Peterson, Omaha; A. C. Everham, Kansas City; A. P. Greensfelder, St. Louis; G. E. Reimann, New Orleans, and P. E. Bostick, Birmingham.

The A.S.M.I. St. Louis Convention

Synopses of the President's address and the papers and discussions on sewerage and sewage treatment, including the latest information covering activated sludge plants and tests; also papers of pavements and paving materials.

The key note of the Convention was expressed by the President in his annual address. It emphasized the desirability of carrying the society into larger usefulness and of bringing the younger men in, as workers and thus transmitting to them the enthusiasm and the constant interest in the Society which has been and is so strong a characteristic of the older men. Several of those who joined the Society before 1900 are still active in its work, regular attendants of the Conventions, regular contributors to its programs and participators in its committee work.

The appointment of new men to responsible positions on committees, their election to office, their participation in the presentation of papers and discussions, all show the application of the same principle.

There is now an evident desire to increase the membership of the society so that its benefits can be more generally distributed and the only thing which may retard its growth is the apparent necessity, at least for a time, of increasing the dues to meet the present high cost of printing.

The relative interest in the subjects discussed at conventions is shown in part by the responses to requests for preferences as to committee assignments. Sewerage, street paving, city planning, water works, were, in order, those having the greater number of votes. For the specification committees, asphalt, brick, bituminous concrete, had the greater number of preferences expressed, the votes for the other positions being quite evenly divided, except that broken stone roads and wood block had no votes.

The following review of the program is taken up in the order of this preference of the members as expressed to the President.

SEWERAGE AND SEWAGE TREATMENT

The program on sewerage and sanitation was very comprehensive, extending from the history of the St. Louis sewer system, extending over 70 years, to a report in the discussions of the beginning of operation of the new sludge-drying apparatus at Milwaukee on Monday of convention week.

W. W. Horner's brief paper on the St. Louis sewer system was so thoroughly organized that it gives a very clear idea of the advances in the science of sewerage in the past 70 years and the application thereof to St. Louis problems. It was supplemented by a number of lantern slides showing views of some of the special designs and structures necessary in the solution of these problems, which were explained by Mr. Horner for Guy Brown, the engineer in charge of sewer construction

Most of the papers were devoted to sewage disposal. Mr. Gascoigne's paper on grit chambers was read by title as neither author nor paper appeared in time for the program.

Professor Edward Bartow's paper on the present status of the activated sludge process reviewed the work which has been done recently. It was illustrated by views of the Houson, Texas, plants, the largest in successful operation in the world and of some English plants, in particular, that at Manchester, the largest foreign plant. The paper was given up principally to the experimental plant in process of installation at Urbana, Ill., by the State Water Survey Division, the plans for which were made by Dr. Bartow, and part of the installation. This plant is now in charge of the new director of the Survey, Mr. Buswell, since Dr. Bartow has transferred his field of activities to the Chemistry Department at Iowa State University.

This Urbana plant will have a capacity of 100,000 gallons of sewage a day and will be equipped for screening, aeration, sludge-drying. The illustrations showed the grit chamber, the Dorr screens and sludge concentration tanks whereby the amount of air necessary in the activated sludge process as greatly reduced. Intermittent aeration will also be tested, according to English systems. Various systems of sludge-drying are to be installed and tested.

Dr. Bartow mentioned also the plant at Argo, Ill., at a large corn products plant, where straight aeration and the Dorr system will be tested side by side.

The Argo plant and that for the Chicago stock yards were described somewhat more in detail by Langdon Pearse in his paper on the work of the Chicago Sanitary District as well as a rather successful application of refuse treatment to tannery wastes on the North Branch of the Chicago river, which will probably be applied to the wastes from the other tanneries of that district. Mr. Pearse also gave a very interesting, though brief, history of the entire work done by the Sanitary District and showed the necessary extensions of this work which must be made into the fields of sewage treatment and regulation of stream flow. The general features of the proposed regulation of the flow of the Niagara and Detroit rivers were noted and it was demonstrated that both stream regulation for increase in dilution in the drainage canal and sewage treatment must be resorted to in order to keep the Des Plaines and Illinois rivers in sanitary condition as the population tributary to them increases.

The improvements in the northern part of the Drainage District were shown in some detail, being some of the later work of the commission.

In the discussion Mr. Pearse referred to the estimates made recently for Bloomington, Ill., showing comparative costs of various sewage disposal systems for an estimated future population of 50,000—sprinkling filters, $630,000, activated sludge, $540,000. But, exclusive of interest, the sprinkling filters will cost $21,000 a year to operate while activated sludge will cost $81,000, credits on which might bring it down to $56,000. The use of the Dorr process might reduce the cost to $51,000. In all these estimates electricity is counted as 2 cents per k.w. hr. Total lack of area on which to dispose of sludge in both Chicago and Milwaukee, makes the choice of the more expensive process imperative. The improvements of the future must be made mainly in the way of reduction in cost of operation.

T. C. Hatton reported that the activated sludge produced at Milwaukee had from 2 to 4½ times the manurial value of sludge from the sprinkling filter plants, whether septic or Imhoff or other preliminary tank treatment, or from 4 to 7 units of ammonia, with value of about $6 a unit. This accounts for the credits given the activated sludge process in the Bloomington estimates. He reported the total cost of operation of the activated sludge process as $35 per million gallons, the credits for value of sludge as $18 and the net cost of operation of the activated sludge process at $17 per million gallons of sewage. His best information is that sprinkling filters on the same basis cost about $15 per million gallons to operate. Electric current in Milwaukee is charged at 1 cent per k.w. hr. and may at times cost less.

Sludge-drying tested in Milwaukee was a failure. Within the past six months the drying of sludge by pressing in two types of presses and four types of plates has been made very satisfactory. Eight per cent of moisture is reached within 1½ hours. However, the character of the sludge changes so decidedly in cold weather that the time required to come down to 8 per cent moisture is increased to 5 or even 7 hours. Chemists report that control of the character of the sludge is possible and experiments are to be made in this line to produce a uniform product if possible. Colloidal chemistry is to be called into use in these tests.

J. C. McVea, city engineer of Houston, reported on their two plants, one of 6,000,000 gallons capacity per day (now handling a little more) and one of 2,000,000 gallons capacity, now handling about 1,000,000 gallons. The electricty rate is 1 cent per k.w. hr. The clear effluent is sufficiently pure and aerated to support fish life even when left by a stream overflow in the settling basin and effluent channel. The sludge is sticky and difficult to convey to the heating tubs where moisture is reduced to 10 per cent.

An operating chart for last December which was shown on the screen showed 96 to 98 per cent reduction in suspended solids, 6 to 6.4 million gallons flow of sewage per day, which is all by-passed while diluted sufficiently by a rainstorm although the operation of the plant is continued to preserve the operation on the sludge. The percentage of sludge in the reaeration channels, based on 30-minute observations, averages 35 per cent, with 30 to 36 as limits. Relative stability, after 10 days incubation at 37 deg. C., is about 98 per cent, on one day faling to 86 per cent. Reduction in oxygen varies greatly between 50 and 84 per cent, averaging 65 to 70.

Nitrates run 40 to 50 parts per million, free ammonia in raw sewage runs as low as 10, averaging 15 to 18, and in the effluent runs fairly uniform at 5 parts per million. Air used is 1.44 cu. ft. per gallon of sewage treated, distributed to the sewage lift .06, to the main aeration tank 0.94, and to the re-aeration channel 0.44 cut. ft. per gallon. The average time in the aeration tank is 2¼ hours; average time of re-aeration 4 hr. 40 min., or a total time in the plant of 6 hr. 55 min. Operating cost of the plant, not including any overhead, is about $14 per million gallons handled in December. The sludge is not treated.

A paper on sewage treatment at Bridgeport, Conn., using Riensch-Wurl screens, was not received in time to present at the convention.

Trade-waste disposal and treatment was discussed by E. S. Dorr, of Boston, who gave the favorable results of an experiment on a small scale of the application of the Miles acid process to tannery waste, and by R. S. Weston, who defined the character of trade wastes and gave examples of results of treatments of each of them. (The former paper we have already printed; the latter will be given soon.)

A paper by W. D. Bee on the experience of the Columbus, Ohio, garbage reduction plant during the first ten years was read by title. (This was published in the November 6th issue of PUBLIC WORKS.)

SNOW REMOVAL

H. S. Richards presented an interesting paper on snow removal by the Chicago South Park Commission with motor plows, horse plows, or shovels and wagons, according to the necessities of the case. This is a very important subject since automobiles and trucks must have streets and roads as clear in the winter as in the summer.

The principal point of the paper is the necessity of having an organization which can be called upon at any time of day or night to get to work promptly and remove the snow as it falls, since snow which has become packed by travel is a very different problem from the fresh snow and demands greatly different apparatus and methods and requires much more time, labor and cost.

The details in the paper show the organization in Chicago, the various apparatus used by it and the methods of procedure. While possibly not exactly applicable to other conditions, the paper and the system deserve the closest study. Since the conditions in the park and boulevard system cover practically all those met on city streets of all sorts and in some cases closely approximate thoseof country roads, any engineer having the snow removal problem on his hands will find something of direct interest to him in Mr. Richard's paper.

PAVEMENTS AND PAVING MATERIAL

The presentation of papers on paving subjects showed in general the same preferences as those shown in the expressions of members regarding assignments to committees.

More papers were devoted to asphalt than to any other paving material, beginning with Herbert Spencer's paper on asphalt production, refining and related problems, illustrated by lantern slides which showed the methods of obtaining asphaltic materials, refining them to produce the desired grades for paving purposes, transporting the asphaltic oils and the refined asphalt, storing the asphalt in cars or tanks at or near the work, in steel and concrete tanks, and transporting it to points of use.

R. R. Barrett's paper on the elimination of unnecessary tests from asphalt-cement specifications was also devoted to the materials and showed the necesity, from the standpoints of convenience and economy, of reducing the variations in the specifications for asphalts for the same use which are met with in common practice. That these variations are unnecessary from the standpoint of quality and efficiency is demonstrated by the fact that this society and the U. S. Bureau of Public Roads have reduced such variations in specifications to a minimum consistent with full definition of the grade and quality of material required for a certain use. The numerous varieties of tests devised by chemists and engineers working independently have been collected and revised by experts familiar with all conditions and with the tests necessary to insure that the proper materials are secured and have been standardized so that, if followed, they will obtain the desired results and with a uniformity not possible under the former lack of system. The effort expended in devising original tests, if exerted in extending the use of the standard tests, would soon reduce this complication and irregularity in value of the resulting pavements.

The basic characteristics of a good asphalt-cement are proper consistency, cementitions property and stability. Other important properties are purity, homogeneity, resiliency and uniformity. These are all determined by means of tests of solubility in carbon disulphide for bitumen content; flash point to detect presence of too light oils; melting point and viscosity to give data as to ease of handling and presence of blown asphalt of low ductility; penetration, to determine hardness or consistency, with limits at 77 degrees for each class of pavement desired and at 32 and 115 degree for susceptibility to temperature changes; loss on evaporation as an accelerated exposure test; penetration after evaporation to show effect of heating in making paving mixture and indication of changes with age at weather temperatures; specific gravity as gage of uniformity and to determine shipping weights; ductility for judgment as to cohesion and brittleness, too high ductility indicating reduction in resiliency and too low ductility lack of cementitionsness and sometimes to indicate certain brands of material.

Other tests not usually necessary if the above are in use are per cent of paraffine scale and of sulphur, solubility in ethyl alcohol and fixed carbon.

The use of the specifications of this society should be extended, as they are concise, contain only the essential tests which insure a high grade of asphalt cement, do not exclude any good asphalts, have no superfluous clauses and therefore should be recognized as the standard of the country and all societies working on this subject.

Julius Adler's paper on the present status of macadam base for bituminous pavements and George Warren's discussion of the subject are given in this issue of Public Works.

John B. Hittell presented a valuable paper descriptive in detail of the methods of construction of asphalt pavement north of Chicago, including drainage and foundation and also gives several traffic counts. It will be good material for the study of the relations of traffic and pavement design and construction. (This paper we published last week.)

Brick pavements were well covered as to present standard methods of construction by J. C. Travilla's excellent paper on paving brick and brick pavements. S. Cameron Corson's paper gave some local history tending to show the advantage of small over block size of bricks for street paving

Although no one seemed to have much interest in wood block pavements, the most earnest discussion was of Hermann von Schrenk's paper on recent experience with wood block pavements.

Stating that many failures of wood block pavements have occurred in the past two years, he attributes them to conditions entirely under the control of the engineer.

He believes that where the present A. S. M. I. specifications for timber are followed few if any failures will occur because of the character of wood used. Tests show that sap wood is as strong as heart wood and that in Douglas fir the weakest wood is in the center of the heart. Failure of sap wood is therefor attributed to nature of treatment rather than quality of the wood.

Preservatives were not always according to specifications but there was but little trouble, the exact quality of preservative being of relatively less importance.

Treatment methods have proven satisfactory in every way and are not responsible for recent failures.

The condition of timber is specified as air-seasoned or green, to be treated within three months of time of paving. Recent experiences seem to indicate that a minimum moisture content should be specified, which would require thorough air-seasoning. Penetration throughout the sap-wood is obtainable only if the blocks are as dry as possible. Steam treatment is not so much to drive out water as to drive out air, which is the principal cause of bleeding, but will not produce equable distribution of creosote oil in a wet piece of wood. Air drying is therefore necessary.

Rigid following of the specification for inspecton is recommended as it is the only one producing results.

The failures of wood block pavements are almost entirely due to the manner of laying them. Unequal swelling of blocks from absorption of water through sand cushions causes bulging.

The failures of pavements and the rotting of blocks due to lack of penetration of sap-wood by the creosote oil, the blocks being comparatively green, was shown by a number of lantern slides and gave rise to a considerable discussion and the members objected to the change of specifications until more experience has been secured.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail ,it may help some one.

Protecting Concrete from Frost

All specifications for concrete construction contain, or should contain, clauses governing such work executed during frosty weather. Sometimes they restrict the work by prohibiting it where the temperature is below 28 or 30 degrees Fahrenheit; sometimes they say it must be safeguarded satisfactorily to the engineer; and sometimes explicit directions are given for the manner in which the work must be carried on in cold weather.

OFFICIAL REGULATION

Where the work is entirely prohibited it might often be allowed if the owner and engineer were confident that that kind of concrete work had been done satisfactorily in very cold weather and that the contractor was able, competent and willing to use methods that will insure such success.

Where it is provided that the concreting shall be done to the satisfaction of the engineer, it is greatly to the contractor's interest to know exactly what is required and what will be accepted, what is optional, and just how the work can be most advantageously perfected.

Even when the methods of concreting are specified in the contract it is possible that the clauses are inadequate, too severe, designed for other conditions, not well adapted to the specific work, or that various points in them could be modified to the contractor's advantage without detriment to the work.

In all of these cases the contractor should be thoroughly informed as to why and when the concrete needs protection, how it can be most efficiently and economically protected, and what methods and appliances have been found most satisfactory by those most experienced in this matter. Such knowledge will enable him to plan his work most advantageously, to anticipate the requirements in making his estimate and in providing his equipment. It will also put him in position to request modifications of unsatisfactory features of the contract and often to suggest changes that will be acceptable to the reasonable engineer and architect, that will benefit the construction and be advantageous to himself. Such information is given in this article and has been prepared from data furnished by concrete experts and by successful high-class contractors who are specialists in concrete construction and have developed efficient and economical methods of handling it in cold weather.

Many contracts for buildings, foundations, piers, arches, tunnels, bridges, highway pavements and other kinds of outdoor work are now in progress but are not likely to be completed before freezing weather sets in, although some of them could be completed within a comparatively short time thereafter if progress is uninterrupted. If the work is left unfinished, to be resumed next spring, it is likely to be subject to some risk or deterioration due to its prolonged incomplete condition, and a large expense is certain to be involved in overhead charges, delayed payments, the removal and storage of plant, the injury to materials, the disorganization of the force, and the lost time of stopping and beginning again, all of which might be saved and interruptions to other work avoided if the work can be carried on to completion without intermission.

Some work may include a minor quantity of concrete, the placing of which governs other parts of the work that might be carried on very advantageously during the winter if the concreting were permitted. Even where the concrete is the major part of the construction, it may frequently be possible to secure much better, cheaper and more reliable transportation and labor during the winter months than before or after. The early completion of the construction is almost always of importance and the saving of several weeks or months by continuing the work during the winter and the putting of the structure into service so much sooner is often of high money value. It is therefore evident that safe methods for winter concreting are likely to be of value and importance to a great many contractors and may even enable them to handle work that they could not otherwise undertake, to keep their organization active continuously all the year round, and to save considerable expense from starting and stopping. These considerations apply to public and private buildings of all sorts, to foundations, piers, bridges, highways, sewers, and, in fact, to almost all kinds of construction that the general contractor undertakes.

In Canada, where very severe cold is encountered, out of 38 cities replying to a questionnaire, 21 stated that they have built sewers during the winter. In the city of Galt, winter sewer construction has been practiced since 1913, when it was commenced for the sake of giving employment to the idle. In St. Johns, N. B., such work is done partly for the sake of maintaining a permanent organized gang ready for emergency work.

From the different replies it is estimated that the increased cost of sewer construction in winter varies from 25 to 100 per cent, although in some cases the excess may be eliminated by the greater abundance of labor, lower wages and the probability that the men will be compelled to work harder to keep warm, although the greatest advantage is thought to be maintenance of organization and the continuity of work that distributes overhead charges throughout the entire year.

EFFECT OF FROST ON FRESH CONCRETE

Official tests to destruction on specimens of 1:2:4 gravel concrete show that when maintained the first 5 days at a temperature of 60 degrees it will develop the normal compressive strength of about 970 pounds per square inch. When seasoned for 5 days at a temperature of 60 degrees and then for 14 days at a temperature below freezing the average strength was only 1,042 pounds, showing a gain of only 125 pounds in two weeks, an increase much less than normal. When the specimens were seasoned 5 days at 60 degrees, and 28 days at a temperature below freezing they developed an average strength of 1,063, showing an increase of only 146 pounds in the four weeks of cold seasoning. The same specimens seasoned for the entire 33 days at a temperature of 60 degrees would normally develop a strength of about 2,000 pounds per square inch, very nearly double the actual strength.

Of course, if concrete is frozen immediately after being placed it entirely loses the advantage of the 5 days' warm seasoning above mentioned, and the strength will be reduced far below that of the above specimens and may indeed be almost nothing and the concrete be virtually destroyed.

These tests entirely discredit the common belief that if concrete sets for 5 days at a temperature of 60 degrees it will afterwards continue to gain strength at a normal rate in a low temperature. Even if it is not actually frozen, the gain in strength will be exceedingly small and slow when the temperature is low.

Other specimens were seasoned for three months at a temperature below freezing and then for 7 days at a temperature of 70 degrees, and when tested some of them showed no appreciable compressive strength. Others were stored for seasoning 4 weeks at a temperature of 70 degrees and developed an average strength of about 700 pounds per square inch, against 2,000 pounds for similar concrete under normal conditions.

This shows that when concrete is frozen and thawed it develops strength very slowly, and that for safe construction the concrete must not only be kept from freezing at first but must be kept warm for at least 4 or 5 days before exposing to the cold, which immediately checks farther gains of strength. It is vital that wet concrete should be prevented from freezing, and it is almost equally important that it should be maintained at a temperature of 60 degrees or more for several days after it has been placed and until it has developed a large fraction of its ultimate strength.

ESSENTIAL REQUIREMENTS

The special requirements for cold weather concreting are that none of the ingredients should be at a low temperature when mixed, that freezing be absolutely prevented, that a comparatively high temperature be maintained for several days after it has been placed, that it be protected from severe cold as long as possible after placing, and that it be temporarily supported if it becomes necessary to subject it to heavy loads soon after placing in cold weather.

To accomplish this, the aggregate and the water should be thoroughly warmed in frostly weather; the cement, being of much smaller volume and necessarily kept dry, does not need special treatment.

The water may be artificially dosed so as to lower its freezing point several degrees and thus prevent accidental injury to the concrete when the temperature is temporarily or unexpectedly so low as to greatly retard the setting.

If the weather is continuously cold or falls below the freezing point at any time, the placed concrete should be artificially warmed and protected.

If it is necessary to strip the forms soon after concrete has been placed in cold weather, it may be necessary to shore or otherwise support beams, girders and slabs until they have slowly developed additional strength.

The chemical reactions involved in the setting of the cement develop a considerable amount of heat that, under favorable circumstances, may be sufficient to prevent freezing when the temperature is only a few degrees below freezing. This, however, is not the case in small masses of concrete or when it is spread in very thin layers or exposed to severe wind, and at best is only temporary, while the setting process is going on, and therefore only prevents injury to the final strength of the concrete but still permits great retardation of its normal development of strength.

Substantially the same is true with regard to any treatment of the mixing water that will lower the freezing point. It is only a makeshift which is valuable to prevent injury from sudden unexpected frost and in nowise increases the strength or hastens the setting of the concrete. On the contrary, some solutions intended to prevent freezing have a distinctly injurious effect on the ultimate strength or properties of the concrete and retard the setting. The only proper way is therefore to have the mixed concrete and the forms at a temperature of 60 degrees or higher when the concrete is placed and to maintain this temperature for several davs afterwards. This can be efficiently accomplished in various ways suitable to different conditions and to the character of the construction.

SIMPLE MEASURES OF PROTECTION

For concrete placed under water there is no difficulty of any sort if it is at a temperature above freezing when deposited, because it is impossible for the concrete to freeze while the water is liquid around it and, although it will set slowly in very cold water it is an advantage to be submerged in any case. Concrete can therefore always be safely deposited in foundation pits, sewer trenches, and other excavations even in the coldest weather, if they can be immediately filled with water that remains unfrozen above the top of the concrete although ice should form on the surface of the water.

If the trenches or other excavations are dry, the heat of the earth is likely to be sufficient to prevent freezing at a depth of over 6 to 10 feet below the surface, provided the concrete is protected on the top from the atmosphere.

Large masses of concrete, such as bridge piers, heavy walls and the like, have a much smaller proportionate exposed surface than small masses, and the chemical heat developed in them may suffice in moderate cold, if the outer surface of the concrete is protected by any adequate covering, preferably an insulating one. In very cold weather such construction may need additional protection in the way of jackets enclosing the forms and protecting them with sawdust or other insulating material, a layer of warm air, or a mass of manure, the decay or fermentation of which will develop considerable heat. In the latter case, however, care must be taken to prevent contact of the manure with the surface of the concrete, which would be discolored. This may be provided for by interposing tar paper, building paper, felt or some other material to separate them.

For light and exposed concrete work, especially such as beams, girders, or slabs, walls, columns, or other structural work, it will generally be necessary to completely enclose the fresh concrete in forms by some kind of a temporary construction that will retain the air surrounding the concrete which should be heated to about 70 degrees and maintained at that temperature for several days. Such provisions are often necessary in building reinforced concrete factories, filter structures and others, and have been developed to a satisfactory degree of efficiency and economy by contractors who have large experience in this sort of work.

By taking such precautions they are able generally to carry on uninterrupted concrete construction and even to begin it in very cold weather at an additional expense of only 5 or 6 per cent of the total cost of the concrete construction in warm weather.

The same considerations apply to the construction of bridges, arch spans, culverts and the like.

Generally the construction of concrete highways and pavements and the bases or foundations for other hard-surface pavement, is not permitted during long-continued cold weather but must be safeguarded for short periods of cold weather or for unexpected frost, and the precautions taken in these cases might sometimes be amplified and modified to permit the construction to be carried on continuously during cold weather if the temperature did not fall too far below freezing. For such work the essentials are to have the aggregate dry and hot, the mixing water warm, to put the concrete in place rapidly on sub-grade which has no traces of frost in it, and then to protect it thoroughly from freezing as soon as it is placed.

The sub-grade may be thawed by open fires or hot blast machines and kept protected until it receives the last course of concrete and is covered and artificially warmed if necessary to prevent freezing and facilitate setting. Movable paper or canvas roofs enclosing an air chamber a few inches over the concrete can be set on the pavement immediately after the concrete surface is finished, and the air can be warmed by steam pipes or properly arranged coal or coke fires maintained as long as necessary; and after the concrete has sufficiently set, if the temperature is not too low, the fires and the covers can be replaced by a thick covering of hay, dry earth or manure maintained as long as the engineer shall direct. The aggregate can usually be heated by wood fires in improvised furnaces buried in the material or by steam pipes, and the mixing water can be heated in kettles or by steam.

Labor Notes

In an open letter to the Board of Commerce the mayor of Detroit urges all employers of labor to ration all work wherever possible in order to keep in Detroit the great body of skilled workmen who are now unemployed. From figures given by the secretary of the Employers' Association it is estimated that 60,000 men are now out of work in Detroit.

The New York State Public Employment Bureau in Brooklyn reports a decrease in the requests from employers for workmen during the last few weeks. Some large industrial establishments there have been laying off workers on account of cancellation of orders or general slackness of business. Chauffeurs, machinists and mechanics are seeking employment. In four weeks in September 469 applicants were placed and in three weeks in October 417. Employers seeking help are offering 20 per cent less than last spring, and an increase in the number of unemployed is reported from Chicago where there is also an influx of workmen that have been laid off in Detroit, in Akron and other cities where the rubber and tire industries have been reduced.

Labor Unions Threaten Engineers

The Building Trades Council of Newark, N. J., has addressed an open letter published in the Newark Call, to engineers and architects, stating that after November 1 plans will not be accepted by the council that do not bear the stamp of the Engineers', Architects' and Draftsmen's Union.

Recent Legal Decisions

SIGNPOSTS AT INTERSECTION OF STREETS NOT DEFECTS—CARE IN MAINTENANCE

In an action for injury to an automobile caused by collision with an overturned "silent policeman," consisting of a heavy circular base and an upright post, surmounted by a sign and a suitable light, the Connecticut Supreme Court of Errors holds, Aaronson v. City of New Haven, 110 Atl. 872, that to make the city liable there must be a defective highway. When in the course of events leading up to the injury to the plaintiff's automobile did this highway became defective? Not by the mere installation of a silent policeman at the intersection of two highways for the purpose of directing traffic and of requiring travelers to obey Section 26 of Public Acts, 1919, c. 233. It could not be said that a sufficiently conspicuous guidepost for traffic placed at the intersection of two streets makes the highway defective. The court took judicial notice of the common use of such devices at such locations and that they do serve a useful purpose in directing traffic and promoting obedience to the law. The fact that such a guidepost is liable to be displaced and to become an obstruction to travel is relevant only as it imposes on the defendant city a commensurate degree of diligence in inspecting the device, or in removing it after it is displaced.

There was evidence from which the jury might have found that the post was knocked down and rolled into the street an hour prior to the automobile striking it, and that the police station was within 12 minutes' walk, and had been notified half an hour previous to the accident. It was therefore held that the jury might properly have found that the city had not acted with reasonable diligence in removing it after notice, and a motion for a new trial on the ground that a verdict for the plaintiff was against the evidence, was held properly refused.

COURT'S DISCRETION AS TO INJUNCTION AGAINST HIGHWAY EXPENDITURE

The South Carolina Supreme Court holds, Wilson v. Cureton, 103 S. E. 789, that in a suit for injunction by taxpayers and citizens to restrain an alleged illegal expenditure of public moneys on highways by the highway commission, the presiding judge has a discretion in granting the injunction. The court thinks it is not wise or prudent to allow public officers to incur large liabilities based upon an honest misconstruction of a statute, and then to tie their hands and stop the work by an injunction. It is also held that in the South Carolina statute of March 1, 1917, directing the employment by the highway commission of a road engineer, and prescribing his duty to survey, locate and relocate, when necessary, every section of road before permanent work shall be done on it, the words "when necessary" refer to "relocate," and not to the whole statute.

"PUBLIC WORKS" DOES NOT INCLUDE PRIVATE REFUSE DISPOSAL PLANT

In an action by the United States for the benefit of a materialman against a contractor with the District of Columbia for the collection and disposal of refuse at a plant to be provded by the contractor and against the surety on his bond, the Court of Appeals of the District of Columbia holds, United States v. Faircloth, 265 Fed. 963, that the Act of Feb. 28, 1899, requiring persons contracting with the District for public buildings or public works to give a bond to secure payment for labor and materials, has no application to the construction of such a plant where it does not appear that the District has any interest in the building or the property on which it is erected.

MUNICIPALITIES' POWER RESPECTING REGULATION OF BUSINESS AND HEIGHTS OF BUILDINGS

In an action by a vendor against a vendee for specific performances of a contract for the purchase and sale of real estate in the city of New York, the question was whether the New York "Zoning" resolution of July 25, 1916, constituted an incumbrance which would relieve the purchaser from its obligation to complete the purchase, as provided by the contract. The resolution divides the real estate into three districts, "residence district," "business district," and "unrestricted district," and regulates the size and height of buildings and the locations of trades and industries. The New York Court of Appeals holds, Lincoln Trust Co. v. Williams Bldg. Corp., 128 N. E. 209, that the resolution is a proper exercise of the police power and did not constitute an incumbrance. The exercise of such power, within constitutional limitations, depends largely upon the discretion and good judgment of the municipal authorities, with which the courts are reluctant to interfere. The conduct of an individual and the use of his property may be regulated, Village of Carthage v. Frederick, 122 N. Y. 268, 25 N. E. 480. In the exercise of the police power the uses in a municipality to which property may be put have been limited and also prohibited. Thus, the manufacture of bricks; maintenance of a livery stable; a dairy; a public laundry; regulating billboards; a garage; the installation of sinks and water closets in tenement houses; the exclusion of certain businesses; a hay barn, wood yard, or laundry; a stone crusher, machine shop, or carpet beating establishment; the slaughter of animals; the disposition of garbage; registration of plumbers; regulating the height of buildings; compelling a street railway company to change the location of its tracks; prohibiting the discharge of smoke; the storing of oil; and, generally any business, as well as the height and kind of building, may be regulated by a municipality under power conferred upon it by the legislature.

NEWS OF THE SOCIETIES

Nov. 15-17—CITY MANAGERS ASSOCIATION. Annual convention at Cincinnati, O. Executive Secretary, Harrison G. Otis, 812 Tribune Bldg., New York City.

Nov. 18-19—AMERICAN ENGINEERING COUNCIL. Organization meeting. Washington, D. C.

Nov. 18-19—FEDERATED AMERICAN ENGINEERING SOCIETIES. Annual meeting. New York; Washington, D. C.

Dec. 7-10—AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual meeting, New York. Secretary, 29 W 39th St., New York City.

Dec. 9—THE BROOKLYN ENGINEERS' CLUB. Annual Meeting, election of officers.

Dec. 13-16—AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS. Annual convention. Washington, D. C.

Dec. 16-17—THE KANSAS ENGINEERING SOCIETY. Annual meeting. Topeka, Kansas.

Jan. 25-27, 1921—THE AMERICAN WOOD PRESERVERS ASSOCIATION. Place of meeting to be announced later.

Jan. 25-27—ASSOCIATED GENERAL CONTRACTORS OF AMERICA. Annual convention. Washington, D. C.; New Orleans.

Feb. 7—AMERICAN ROAD BUILDERS' ASSOCIATION. Annual convention. Coliseum, Chicago. E. L. Powers, 11 Waverly Place, New York City.

AMERICAN WATERWORKS ASSOCIATION, NEW YORK SECTION

The New York Section of the American Water Works Association held its regular monthly meeting at Hotel McAlpin October 20. More than seventy members and guests were present and after luncheon was served the meeting was addressed by President William W. Brush, chief engineer of the Department of Water Supply, Gas and Electricity, New York City, and by Beekman C. Little, president of the American Water Works Association. The principal address was made by Professor George C. Whipple, of Harvard University, on eight months in Europe with the Red Cross societies, in which he gave information concerning the water supply and sanitary methods and conditions in the war zone.

DISCUSS HOUSING CONDITION AT DETROIT

Dr. Henry F. Vaughan, health commissioner of Detroit, announces that a national conference of health officers to consider housing questions will open at Detroit, Mich., on November 30.

PROFESSOR WHIPPLE ADDRESSES AMERICAN WATER WORKS ASSOCIATION

At the meeting of the New York section held in New York City on October 20, Professor George C. Whipple of Harvard University, for the past eight months chief of the Department of Sanitation of the League of the Red Cross Societies, with headquarters at Geneva, Switzerland, outlined some of his work abroad and some of the prospective work of his successor, Colonel F. F. Longley.

During his stay abroad, Professor Whipple gave special attention to sanitary surveys, water supply studies and public health education. The public water supplies in the European countries, especially in Roumania, are deplorable, in some cities there being none whatever. In Roumania and other parts of Europe (affected more than others by the war) filter plants and pumps are out of use entirely on account of the lack of small parts which cannot be obtained at any price.

There is very little public health education in Europe outside of England. "Some instruction in the subject is given in medical schools, but this is by doctors and is quite inadequate, especially along sanitary lines. Professor Whipple says that it is possible that a school of public health will be established in Switzerland, which may be a government school, or it may become international in character.

He also stated that the League of Red Cross Societies, in conjunction with the Tuberculosis Commission of the Rockefeller Foundation, is carrying on a public water supply study in France.

Colonel Longley is now engaged on a glossary of terms used in sanitation and public health.

FIFTH INDUSTRIAL SAFETY CONGRESS

Among the speakers at this congress, to be held December 6-9, under the direction of the State Industrial Commission, at Syracuse, N. Y., will be Dr. R. M. Little, director of the American Safety Institute, New York City; C. H. Thompson, safety engineer, Eastman Kodak Company, Rochester; C. L. Smith, safety engineer of the Carborundum Company, Niagara Falls.

The students of the Syracuse School of Oratory will present moving pictures, tableaux and pageants to demonstrate safe and unsafe practices.

Willard A. Marakle of Rochester is chairman of the committee on invitations and publicity and Mark A. Daly of Buffalo is chairman of the program committee.

HIGHWAY CONTRACTORS FORM ORGANIZATION

The Pennsylvania highway contractors recently held a meeting in Harrisburg and appointed a temporary committee to draft a constitution and by-laws and prepare other details for the organization which is to be known as the Associated Pennsylvania Highway Contractors. Sixty contractors were present. H. H. Wilson of Winston & Co., has been made chairman and E. J Harding of the Associated General Contractors of America will assist in perfecting the permanent organization of the association.

LOUISIANA ENGINEERING SOCIETY

At the regular meeting of this society held Monday, November 8, Mr. John Klorer spoke on "The Proposed Separation of the Red and Atchafalaya Rivers from the Mississippi and Its Effect on Flood Heights."

YORK ENGINEERING SOCIETY

The Engineering Society of York, Pa., voted on October 18 to join the Federation, and the Washington Society of Engineers took similar action on October 20.

DETROIT ENGINEERING SOCIETY

The Detroit Engineering Society has appointed D. J. Sterrett to represent it at the meeting of the Council, and the Buffalo Engineering Society has appointed W. B. Powell.

The Florida Engineering Society has appointed L. R. McLain as its representative at the Council.

AMERICAN INSTITUTE ELECTRICAL ENGINEERING

The board of directors of the American Institute of Electrical Engineers has appointed the following members of the Institute on the American Engineering Council: Comfort A. Adams, Cambridge, Mass.; A. W. Berresford, Milwaukee, Wis.; H. W. Buck, New York; F. L. Hutchinson, New York; W. A. Layman, St. Louis, Mo.; William McClellan, Philadelphia, Pa.; L. F. Morehouse, New York; L. T. Robinson, Schenectady, N. Y.; Charles S. Ruffner, New York; L. B. Stillwell, New York; Calvert Townley, New York.

AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS

The southern section of this society held a two-day meeting in Memphis, Tenn., on August 30 and 31, devoting its attention to agricultural engineering problems as they are found in the South.

Among the papers presented were "Methods of Conducting Drainage Extension Work in the South," by S. H. McCrory, engineer in charge of rural engineering, Washington, D. C.; "Dynamiting," by P. H. Williams, Memphis.

The closing afternoon of the meeting was devoted to inspection of the experimental work being carried on under the supervision of C. E. Ames, assistant director at the branch experiment station at Holly Springs, Miss. These experiments have to do with reclaiming and conserving land by the use of terraces in connection with certain special devices for preventing erosion.

CHICAGO SAFETY COUNCIL

A series of addresses and instructions in safety principles and practices is to be given to managers, engineers, superintendents, safety department employees and others interested by the Chicago Safety Council, which was organized by the Chicago Association of Commerce.

THE OKLAHOMA HIGHWAY ENGINEERS' ASSOCIATION

The following officers were elected at a meeting held at Oklahoma City: President, Will M. Clarke, first vice-president, Pearl Little; second vice-president, Floyd F. McMaster, secretary treasurer, Frank Herman.

AMERICAN SOCIETY of MECHANICAL ENGINEERS

The principal topic at the annual meeting of the American Society of Mechanical Engineers, December 7-10, New York City, will be "Transportation," including railroads, waterways, feeders, motor trucks and the terminal problems in New York City.

The professional section topics will include fuels, machine shop, management, railroad, textile, power, wood working, research, design, and miscellaneous subjects. L. P. Breckenridge will speak on the "Fuel Supply of the World." The management section will exploit the life and work of the late Henry L. Gantt. The principal topics of the railroad section will be "Static Adjustment of Tracks on Curves," by R. Eksergian; "Increasing Capacity of 'Old Locomotives," by C. B. Smith, and "Modernizing Locomotive Terminals," by George W. Rink. At the research session D. E. Foster will speak on "The Flow of Fluids through Pipe Lines, and the Effect of Pine Line Fittings." N. W. Akimoff will speak on "Foundations for Machinery."

AMERICAN ASSOCIATION of ENGINEERS

Gardner S. Williams addressed the opening fall meeting of the Ann Arbor Chapter, October 7, on "The Power Possibilities of the Great Lakes-St. Lawrence Waterway." James S. Bowman of the Fargo Engineering Co., Jackson, Mich. spoke of the need for greater restriction in the development of power in the National parks.

Dunsmuir, Cal., has recently organized a chapter with the following officers: L. H. Taylor, president; G. M. Taylor, first vice-president; V. E. Parker, second vice-president: J. G. Standley, secretary-treasurer.

WESTERN SOCIETY OF ENGINEERS

The Journal of this society is to become a monthly beginning with the October issue. It will give less attention to matters of general engineering interest fully covered in the weekly engineering press, give immediate reports of the month's meetings, keep the membership completely in touch with the work of each committee and will contain in full such technical papers as are of certain general interest to the membership, revising and giving abstracts of the others.

PERSONALS

Allen, J. J., director of the research laboratories, American Society of Heating and Ventilating Engineers, has been appointed consulting engineer on ventilation to the chief engineer of the New York and New Jersey commissions in charge of the construction of the Hudson river vehicular tunnels.

Blood, Louis H., formerly chief engineer of the Osterlan Machinery Co., Cincinnati, has opened an office in that city.

Bidwell, Frank, has been appointed executive secretary to Thomas J. Wasser, state highway engineer of New Jersey.

Barde, J. M., is to supervise the construction work on the Carthage section of the Carthage Carterville concrete road.

Carpenter, L. G., has been employed by the San Diego, Cal., water commission to furnish plans and estimates for converting Dulzura creek into a conduit which will convey the city water supply from Dulzura to Lower Otay.

Calvert, Lt.-Col. L. L., formerly of the construction service, U. S. Army, has returned to his pre-war position as chief engineer with the Tidewater Building Company, New York City.

Calvert, D. Gordan, has been appointed resident engineer in charge of the construction of the Fort William Paper Co., at Fort William, Ont.

Cooper, Sidney W., has been appointed assistant division engineer, 4th division, Alabama Highway department.

Green, A. M., has been appointed engineer of Modac Co., Cal.

Holgate, Henry, consulting engineer, has been retained by the Department of Railways and Canals, Montreal, to report in the power shortage in Trent Valley, Ont., and the development of greater power along the Trent canal by the Hydro-Electric Power Commission of Ontario.

Hoover, Clarence B., has been appointed engineer in charge of the bureau of water works extensions of Columbus, Ohio.

Johnson, Dean A. N., of the college of engineering in the University of Maryland, has been appointed chairman of the National Highway Council of the American Association of Engineers. This council will be organized similarly to the railroad and federal councils of A. A. E.

Lyon, L. E., a civilian member of the army engineer staff in the Norfolk district, has been commissioned a major.

Lanagan, N. H., commissioned major of engineers, has been assigned to the Fifth Regiment at Camp Humphreys.

Lawson, Wilfred S., has been appointed bridge and structural engineer in the Department of Railways and Canals, Ottawa.

Lautz, George H., has been appointed assistant engineer of the U. S. Forest Service, Washington, D. C.

McCabe, J. J., has been appointed general superintendent of a dam at Decatur, Ill.

Merkt, Ol, formerly with Westinghouse, Kerr & Co., has been made assistant chief engineer of the American Can Co., with headquarters in New York.

Newcomer, Col. Henry C., has been appointed division engineer of the U. S. engineer department with headquarters in New Orleans.

Salmond Bros. Co., of Arlington, N. J., have changed their corporate name to Salmond, Scrimshaw & Co.

Scott, J. H., has been appointed division engineer for The Dalles, Oregon state highway commission.

Whittemore, Walter F., has been appointed by Governor Edwards to serve on the State Board of Public Utility Commissioners of New Jersey.

Tuippa, H. M., has accepted a commission as major in an engineer regiment of the U. S. Army.

Weldon R. Lawrence has joined the Fort Frances Pulp & Paper Co., Fort Frances, Ont., as resident engineer in charge of engineering and construction.

Wilson, H. Lee, has been appointed city engineer of Johnstown, Pa.

Washington, Walter, has been appointed city manager of Charlottesville, Va., succeeding Shelton, S. Fife.

Macomber, Grant C., architect and engineer, formerly at 11 Doyle Bldg., Flint, Mich., has taken larger quarters at 616 Genessee County Savings Bank Bldg.

Riley, Lee, hydraulic engineer, has been appointed engineer for the Leavenworth and Fort Leavenworth Water Co., Leavenworth, Kan.

Herr, Hiero B., died at Dillsburg, Pa., September 3.

Jones, Louis B., on the engineering staff of the Maine Highway Commission, died October 12 at Portsmouth, N. H., while attending a conference on the new interstate bridge.

Parker, Philip A. Morley, one of the leading engineers in the Federated Malay States, died at Kuala Lumpur on August 4.

Thompson, Emerson, chief engineer on bridge and canal work for Manning & McDonald, died recently at Spokane, Wash.

Waters, William, formerly of the engineering firm of Baker, Carpenter & Waters, San Francisco, died October 16.

Porter, S. D., city engineer of Peru, Ill., died at LaSalle, Ill., September 12.

Henderson, Ernest G., civil engineer, Windsor, Ont., died October 13.

Cattell, Major William A., consulting engineer, died on October 10.

GEORGE H. INGRAM

George H. Ingram, vice-president of Warren Brothers Company, Boston, died at his residence in Nashville, Tenn., October 28, after a few weeks' illness with typhoid fever. Before his association in 1902 with Warren Brothers Company, Mr. Ingram had organized the Nashville Roofing and Paving Company and was prominent in road building and pavement construction. He took an active part in all the conventions of the American Society for Municipal Improvements. His death is a serious loss to the highway interests of this country.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

CLETRAC

The Cletrac, a light and handy tractor manufactured by the Cleveland Tractor Company, weighs 3,400 pounds, has a speed of 1 to 5 miles per hour, is 96 inches long, 50 inches wide and 52 inches high and is operated by a 4-cylinder motor with 4-inch bore and 5½-inch stroke that develops a draw bar h. p. of 12 and a belt h. p. of 20, with 20 per cent emergency reserve. It is provided with two 50 x 8-inch caterpillar tracks, reducing the load on the ground to 4¼ pounds per square inch.

It is especially recommended for road building operations and it replaces 6 to 8 horses or mules in hauling grading and dragging machines, plows and trailers. It is also useful for general construction work, hauling heavy truck loads over poor roads and extricating them from bad places as well as for handling heavy timbers, moving machinery and even for operating rock crushers and concrete mixers in emergency. It operates well over rough and soft roads and on steep grades, and is of sturdy construction.

It is useful to replace switch engines and spot freight cars for loading and unloading, and is very convenient for hauling heavily loaded trucks over bad roads, and for pulling them out of soft or rough places that stall them when they can pass elsewhere over good roads.

The street commissioner of Union City, Pa., reports that one of these tractors has been used for all road and street work, much of it on unpaved streets, and during the month of September, when it was in service 16 days, the total expense for gas, oil, and other incidentals was $39.80, while the cost of horses for doing the same work would have been $264. The mayor of Athens, Tex., writes that he estimates the saving of a Cletrac over equivalent mule service to be $11 per day.

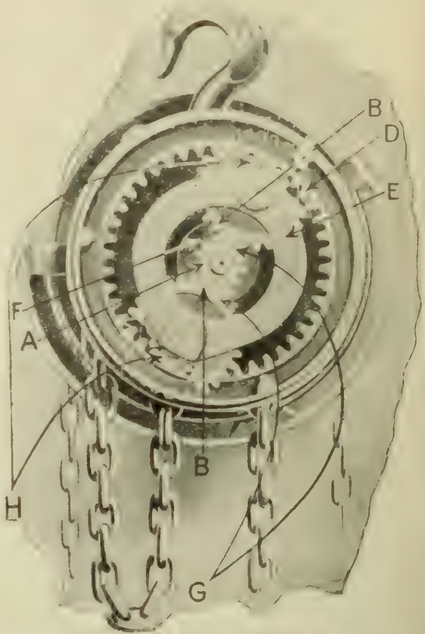
YALE SPUR GEARED CHAIN BLOCK

This hand hoist is especially convenient and efficient for lifting heavy weights of moderate dimensions that have to be frequently raised to a small height where labor is expensive. It is adapted to be used in a fixed position or to be attached to a trolley and is very rapid in operation.

It is built in seventeen sizes of ¼ ton to 40 tons capacity, each of them being tested at the shop by lifting a load of 3,360 pounds per ton rating.

One man pulling 80 pounds on the operating chain easily and quickly lifts a 1-ton load with a minimum friction. The block holds the load wherever it is kept and only lowers it when the chain is pulled for that purpose.

The block, which is here shown with the case removed, is designed on the planetary gear system by which the load is distributed equally on every tooth of every gear and their bearings, thus reducing the wear to a minimum. Pulling the hand chain revolves the sprocket wheel and the pinion A keyed to its axle, thus operating the two intermediate gears BB that mesh into the internal gear D at H and operate the pinion cage E and sheave F which lifts the load. Friction is reduced by roller-bearings, equilibrium is maintained by the balanced pressures no matter what the position of the load, and the whole device is very compact and is protected by the exterior case that encloses all the mechanism.



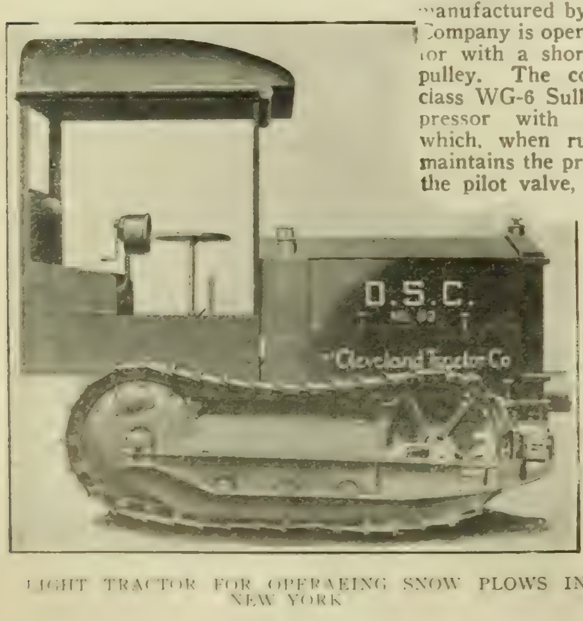
SPUR GEARED CHAIN BLOCK

SULLIVAN PORTABLE AIR COMPRESSOR

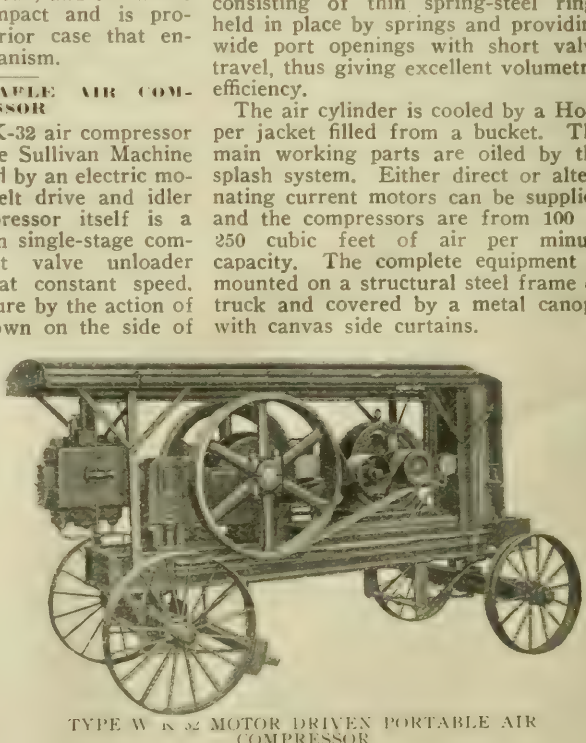
The new type WK-32 air compressor manufactured by the Sullivan Machine Company is operated by an electric motor with a short belt drive and idler pulley. The compressor itself is a class WG-6 Sullivan single-stage compressor with inlet valve unloader which, when run at constant speed, maintains the pressure by the action of the pilot valve, shown on the side of the air cylinder. When the pressure exceeds the required amount the pilot valve raises the inlet valves from their seats and allows the piston to reciprocate without load until the pressure falls and releases the pilot valve.

The inlet and discharge valves are of the improved Sullivan wafer pattern consisting of thin spring-steel rings held in place by springs and providing wide port openings with short valve travel, thus giving excellent volumetric efficiency.

The air cylinder is cooled by a Hopper jacket filled from a bucket. The main working parts are oiled by the splash system. Either direct or alternating current motors can be supplied and the compressors are from 100 to 250 cubic feet of air per minute capacity. The complete equipment is mounted on a structural steel frame or truck and covered by a metal canopy with canvas side curtains.



LIGHT TRACTOR FOR OPERATING SNOW PLOWS IN NEW YORK



TYPE WK-32 MOTOR DRIVEN PORTABLE AIR COMPRESSOR

PUBLIC WORKS.

CITY COUNTY STATE

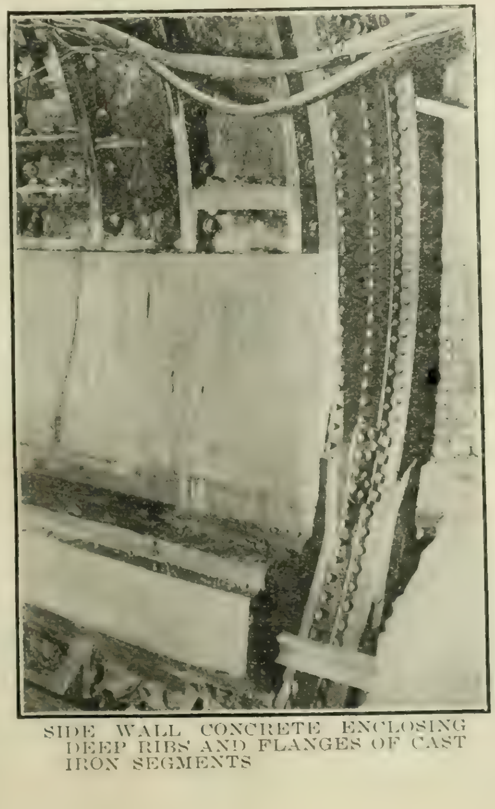
A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 49 FLORAL PARK, NOVEMBER 20, 1920 No. 21

Concrete Lining for Cast Iron Tunnel Shells*

Steel forms, travelers, and concreting operations in the four tunnels under the East river, New York. Difficulty experienced in setting forms on curves and to provide for variations from line made in driving the tunnel. The concrete lining was placed in six successive operations.

The four double-track subway crossings of the East river, New York, at 60th street, at 14th street, at Old Slip and at Whitehall street, involved the construction of about 61,100 linear feet of single-track tunnels, including 17,500 feet of cast iron tubes driven by the shield method under the river bed and adjacent to it which, after completion, were lined with concrete having, in the arch, an average thickness of about 14 inches, and extending about 6 inches beyond the projecting ribs of the cast iron segments.



SIDE WALL CONCRETE ENCLOSING DEEP RIBS AND FLANGES OF CAST IRON SEGMENTS

The circular inner surface of the arch concrete has in general a diameter of about 15½ feet. Below the springing line the horizontal clear width of the finished tunnel is diminished by the construction of the duct benches which in cross-section have rectangular offsets extending down with vertical faces to the horizontal invert concrete on which the track is laid.

The total concrete involved in the tunnel lining amounts to a little more than two cubic yards per linear foot of single track, and is nominally, as stated in the previous article, proportioned 1:2:4 of cement, sand and gravel up to ¾-inch diameter It was mixed in drum machines located at the feet of the shafts and, excepting a small quantity handled by the pneumatic conveyor system, was delivered by dump cars drawn by electric mine locomotives to the points where used.

ADJUSTMENT OF FORMS

One of the most essential functions of the concrete lining was to provide additional insulation for the third rail, which required a minimum of at least 1 inch and preferably 2 inches of covering. Owing to the impossibility of driving the tunnel, in shield excavation, with exact accuracy, the alignment of the cast iron lining varied somewhat and difficulty was experienced, on the sharp curves, in setting the forms so as to overcome the irregularities, clear all of the projections and give a sufficient body of concrete to properly enclose the projecting ribs of the cylindrical segments and the angle of the duct banks. The rigidity of the heavy forms made it difficult to spring them, and the entire length had to be adjusted, causing more labor and delay than would have been the case with a flexible construction more easily adapted to local variations.

On tangents the variations were overcome in some cases by raising the entire traveler or by shifting the tracks, and in some cases slight changes of alignment were found necessary. After they had been made, the forms were adjusted without difficulty except on the curves of 275-feet and 300-feet radius, where special forms, 20 feet long, were made curved to the required radius. Before these were provided considerable difficulty had been experienced in trying to force the regular forms into position by wedging, jacking and other difficult operations.

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*Part I. Mixing and Transporting Concrete, was published September 18, page 247.

Wherever there was any eccentricity between the forms and the lining, the reduced clearance on one side impaired the efficiency of spading and made it more difficult to insure maximum density of concrete and particularly hard to force the concrete up against the stiffening ribs and flanges of the cast-iron segment, where some voids occurred that were subsequently filled with grout.

CONCRETING OPERATIONS

The concrete lining was placed in six successive operations, as shown in the cross section, which, although for a tunnel in rock without cast iron lining, gives the correct method of placing the concrete in all tunnels of this work; the limits of the courses; and the order of the operations indicated by the joint marks and by the sequence of the numerals. The drawing is also of interest in that it shows the special lead sheet introduced at all expansion joints, 25 feet apart, to prevent the possibility of leakage through the construction joints.

Concrete for the invert, with a horizontal upper surface about 6 feet wide and depth of about 19 inches at the center point, was, in the first operation, dumped in position in the bottom of the tunnel without forms and the upper surface was screeded to a horizontal in lengths of about 100 feet by 15-man gangs advancing about 80 feet per eight-hour shift.

In the second operation, sections number 2 on opposite sides of the tunnel, called the aprons, were made in light wooden forms through which the concrete was delivered from cars operating on the preliminary high level track. When this concrete was several days old the 24-inch service track, on which spoil and materials were handled by electric mine locomotives, was laid on the center line of the invert and a 6-foot track was laid there concentric with it, on which were operated the travelers from which the concrete was delivered for the remainder of the lining, which was built in Blaw steel forms.

The concrete for the second courses was deposited behind wooden forms made in short sections that could easily be lifted by hand. The horizontal lagging boards were nailed to vertical ribs about 12 inches apart that were notched at the lower ends to offset the apron course and were fastened to top and bottom longitudinal pieces against which inclined braces were set, holding them in place and still giving clearance for the tunnel cars and locomotives.

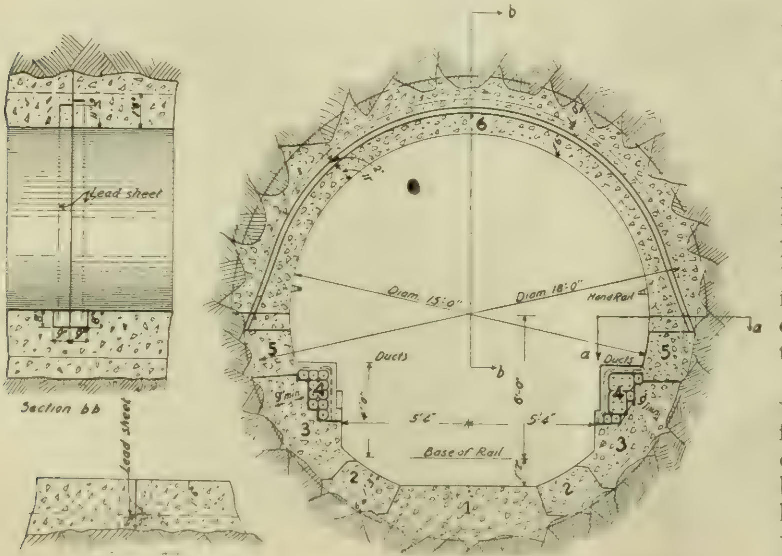
In the third operation, the duct benches were built up to about 4 feet above the top of the invert and to the bottom of the duct tiles.

In the fourth operation the duct tiles were laid in cement mortar, with slightly different arrangement on opposite sides of the tunnel.

In the fifth operation, the banks of duct tiles were enclosed in concrete which protected the tops with a horizontal surface forming a narrow sidewalk and was continued up above it 3 feet as a curved side wall reaching to the spring line. The steel forms in which this course was concreted were stiffened by wide vertical transverse plates, making a frame-work suspended from the overhanging caps of the traveler and adjustable by turnbuckle struts by which they were moved out horizontally to the required position for receiving the concrete, or were withdrawn transversely from it, thus stripping the forms from it after it had set.

In the sixth operation the arch concrete was shoveled into place between the permanent cast iron lining and the semi-cylindrical steel forms, which consisted of curved plates put in position from the bottom up as the work advanced and supported on transverse steel ribs braced together to form units 20 feet long. These units were supported at the ends and at intermediate points on the transverse caps of the traveler and were set to receive the concrete or stripped from it by the adjustments in the supports. Usually five units were used together for the construction of 100-foot lengths of lining, which were concreted by a 15-man gang in from two to three eight-hour shifts.

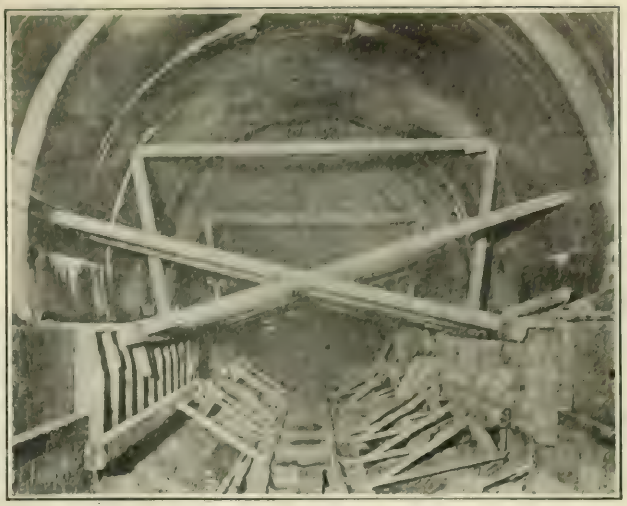
The form travelers were built with several bents of vertical posts framed to top and bottom longitudinal sills and carried, in each bent, horizontal transverse caps that overhung at each end and supported the working platform or the concrete forms or both. Between the vertical posts and under the caps, there was



SEQUENCE OF CONCRETING OPERATIONS SHOWN BY NUMERALS AND RADIAL CONSTRUCTION JOINTS sufficient clearance for the material cars and locomotives handling the spoil, concrete and other supplies and materials, thus enabling the concreting to be carried on without obstructing other tunnel operations.

Lake Michigan to Gulf of Mexico by Water

Among the many projects for canal construction being advocated in all parts of the country, one of the more ambitious ones is that of linking the Gulf of Mexico with Lake Michigan by means of the Mississippi and Illinois rivers, supplemented by river improvements and canals. The last link in the chain of the canals and river locks necessary to complete this project has now been contracted for, this being the locks at Marseilles, Illinois.


FORMS AAD BRACING FOR DUCT BANKS

New Sewage Treatment Plant of Okmulgee

By A. H. Kindrick*

This is the first plant to be constructed and operated under the new sanitary law of Oklahoma. It consists of a pumping plant, Imhoff tanks, dosing tank, sprinkling filter, and sludgs beds for a million gallons a day.

The rapid growth of cities and towns in Oklahoma, where the provisions for sewage disposal have not kept pace with the increase in population, is causing serious pollution of the water courses in the state.

According to the report of J. W. Evans, former engineer for the State Board of Health, sixty-three out of one hundred and ten sewer systems had at one time been provided with some kind of a treatment plant. Very few of the plants, however, were capable of producing good results and many of them were abandoned after a brief period.

At the present time, judging from reports and from the writer's own observation, 90 per cent of the sewage, from a connected population of over one-half million, is discharged into the streams either directly or after passing through a treatment plant, which, to quote Mr. Evans, "does not do the sewage much harm."

Sanitary Laws. In 1917 the State Legislature of Oklahoma passed "An act to preserve the purity of the waters of the state." By the provisions of this act, all plans for sewer systems and sewage disposal plants thereafter constructed must have the approval of the engineer of the State Board of Health.

Okmulgee is the first city in the state to complete and put in operation a sewage treatment plant in compliance with the new law.

History of Okmulgee Improvements. The history of sewer improvements in Okmulgee, until the beginning of the new work, is typical of other towns throughout the state.

Okmulgee, with a population of 17,430, lies in a valley drained by Okmulgee creek, which flows south through the center of the town and empties into Deep Fork of the Canadian river. As early as 1904, Okmulgee, then a town of about 2,000 inhabitants, built water works and sewers and constructed a septic tank some distance beyond the town limits. Both the water and sewer systems were extended from time to time until the town grew out and around the site of the septic tank, which became filled with sludge and was abandoned. An outfall sewer about three miles in length was then laid to carry the sewage to Deep Fork. This sewer, a 12-inch pipe, with the influx of population due to the oil industry, was soon overloaded. Sewage from the overloaded out-

PUMPING STATION AT LEFT, IMHOFF TANKS AT RIGHT

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*Supervising Engineer of Burns & McDonnell Engineering Company

DOSING CHAMBER IN FOREGROUND. SPRINKLING FILTERS IN REAR

fall was flowing into the creek within the city limits and other outfalls were discharging just outside the lower part of the town at the time the new improvements were begun. After securing the approval of the engineer of the State Board of Health to the plans and specifications, contracts were let in September, 1916.

NEW SEWERAGE SYSTEM

The principal feature of the sewer extensions is an intercepting sewer of twenty-one-inch pipe and smaller sizes to collect the sewage from the overloaded old system and provide drainage for new mains; and a new outfall twenty-four inches in diameter. There are at present thirty-five miles of main and lateral sewers connected to this outfall. The grade of the outfall is 0.12 per cent, but even this light grade is greater than the fall of the creek. It is, therefore, necessary to raise the sewage by pumping in order to carry it through the treatment plant and discharge the effluent into the natural drainage.

The plant site consists of six and one-half acres of level ground on the bank of Okmulgee creek about one and one-half miles out of town.

Pumping Station. The pumping station is a brick superstructure over a reinforced concrete pit. The building is 19 feet wide by 25 feet 4 inches long; the pit is divided longitudinally by a water-tight wall into a screen chamber and a dry pump pit. The sewage enters the screen chamber seven feet below the natural ground level, where it passes through an inclined bar screen with ¾-inch openings. There are three vertical centrifugal pumps each with a capacity of five hundred gallons per minute. One pump operates continuously through the night; two are in use during the day and a third is in reserve or used during unusually heavy flows. Each pump is driven by a seven and one-half h. p. motor set in the motor room above the pit. The motors are automatically started and stopped by electric switches operated by floats in the screen chamber.

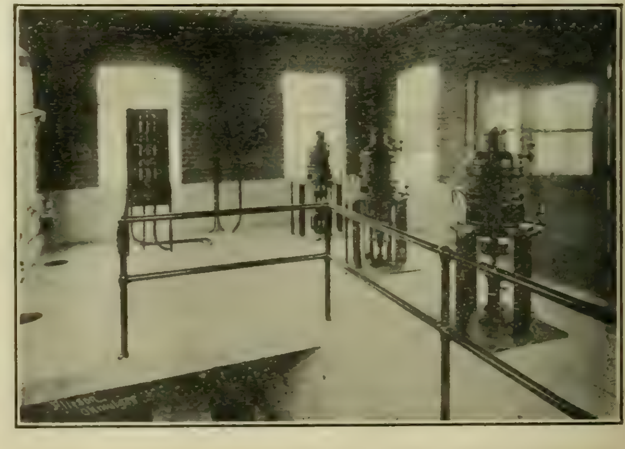
Imhoff Tanks. The pumps lift the sewage into two Imhoff tanks where the normal sewage level is twelve feet above the original ground surface. The two tanks are built side by side as one rectangular concrete structure 37 feet 2 inches wide by 73 feet 6 inches long, outside dimensions, and 26 feet from the top of the gas vents to the bottom of the hoppers. The outside walls are vertical down to the sludge hopper and are of the buttress type. The tanks are each 17 feet 6 inches by 72 feet, inside, and the sewage depth is 22 feet. Each tank is divided, lengthwise, into two settling compartments, over a common sludge chamber, with a 6-inch slot between the overlapping sloping walls. A continuous gas vent 2 feet wide is left between the settling compartments and one foot wide between the settling compartments and the tank walls. For the convenience of the operator, walks are built on top of the division wall and also on each side of the central gas vent in each tank.

The two tanks have a combined settling capacity of 97,000 gallons and a sludge capacity of 14,000 cubic feet. The tanks are designed to treat 1,000,000 gallons per day with a detention period of two hours. The tanks are arranged for either direct or reverse flow, suitable stop boards being provided in the channels and removable plates in the inlet (or outlet) weirs. Scum walls extending eighteen inches below the sewage level are set two feet inside the tanks across each end.

Sludge Beds. Two sludge beds, each 40 feet by 80 feet, are located one on each side of the Imhoff tanks, with space for future extensions. The sludge bed construction consists of low concrete walls within which is a level bed of sand six inches thick underlaid with drain tile bedded in gravel.

Dosing Tank. The effluent from the Imhoff tanks flows to a hopper-shaped dosing tank equipped with an eighteen-inch siphon, set for discharging when the effluent level is within three inches of the sewage level in the Imhoff tank and has a draw-down of five feet.

Sprinkling Filter. The filters are designed for a flow of three-quarter million gallons per day to operate at a rate of two and one-half million gallons per acre per day. The maximum head on the nozzles at siphon discharge is eight feet and the minimum is three feet. The filter bed is composed of the very hard and non-impervious Joplin flint, ¾ inch to 2½ inches in size and averaging 5½ feet in depth. The underdrain system is 6-inch split tile laid open side down in parallel rows ten inches apart on a concrete floor which slopes to the main drains. The main drains are gutters of 15-inch split tile. Vent chambers are con-



INTERIOR OF OKMULGEE SEWAGE PUMPING STATION structed at the ends of the tile drains. Eight-inch sewer pipe risers reach from the vent chambers to above the filter walls, with elbows turned to catch the breeze from any point of the compass.

Care and Operation. Unlike many towns, Okmulgee is prepared to protect and care for its investment. The grounds have been fenced with a high and strong woven wire fence. The embankments have been sodded with Bermuda grass, and an operator is employed to give the plant constant attention.

Some trouble was experienced at the outset in the operation of the pumping plant due to stoppage of the screens on the suction pipes. This stoppage was found to be caused by cotton waste from garages and machine shops. An auxiliary screen was put in outside the building where the coarser refuse is disposed of. The operator now has little difficulty, after cleaning both bar screens, in keeping the suction lines clear.

Foaming over in the gas vents in the Imhoff tanks occurred once, but after thoroughly breaking up the scum and reversing the flow it stopped and has given no further trouble.

The plant is producing a very clear and stable effluent and there is no offensive odor in its vicinity.

The operation of the plant is under the direction of T. P. Paxton, Assoc. M. Am. Soc. C. E., commissioner of public works of the city of Okmulgee.

The plant was designed and construction supervised by Burns & McDonnell Engineering Company of Kansas City, Mo.

Mosquito Extermination at Greenville, Texas

The city of Greenville on September 24 passed an ordinance declaring mosquitoes and the breeding of them a nuisance and fixing penalties for certain specified offences in connection with the breeding of mosquitoes. Because of the annoyance and danger created by the mosquito, the council passed this as an emergency measure, to take effect immediately upon its passage.

The ordinance creates a mosquito district, which includes all of the city and for a distance of 5,000 feet beyond the corporate limits. It defines as a mosquito breeding or propagation place any collection of water in which mosquito eggs are laid or deposited, mosquito larvae or mosquitoes are grown and developed, including "any can, vessel, barrel, gutter, ditch, basement, pool, reservoir, cistern, low place, hole, sewer or anything or place holding water where mosquito eggs are or may be laid or deposited." Any such places are declared to be a nuisance and it is made unlawful for any person owning, occupying or in charge of any premises in the district to permit such breeding places to exist. Proper means and precautions must be taken to prevent such breeding and it is unlawful for owners of such property to fail to destroy all mosquito eggs and larvae on his premises. Wire screening of not to exceed 16-mesh must be placed on openings to cisterns, including gutter openings, on water barrels, vessels or conductors which hold water. Owners must cut and destroy all weeds or other vegetable matter about every collection of water on their premises where mosquito larvae can hide. Also weeds or grass in which mosquitoes can hide.

Other means suggested in addition to screens and cutting grass is to stock all water in basins or other depressions in the ground with what is known as pot-belly minnows, cut the grass along the edges of the water and keep the surface of the water free from floating vegetation. Where the water is not intended for use, it must be removed from its container within five days after collecting there or the container be filled with earth so as not to retain water; or failing this, the water shall be kept covered with kerosene, crude oil or any other product of petroleum answering the same purpose.

Fines are imposed of not less than $5 nor more than $200 for each offense, each day being deemed a separate offense.

Street Work in Fitchburg

Cost of cleaning streets. Patrolmen, pick-up sweeper and motor flushers used. Oiling streets. Assessing sidewalk costs.

Last year the street division of the Department of Public Works of Fitchburg, Mass., owned and maintained 24 horses, 6 new horses being purchased during the year and some of the older ones disposed of. On the basis of three hundred working days a year, the cost per horse for hay, grain, straw, shoeing, harness repairs and stable repair was $2.29 per horse per day, an increase from $1.26 in 1916, the increase of 82 per cent being due to the higher cost of labor and supplies. Hired double teams are paid $1 an hour, and it is estimated that, with the cost of supplies and labor as they are now, it makes little difference to the department from a financial point of view whether teams are owned or hired.

In his annual report, David A. Hartwell, Commissioner of Public Works, says that with motor trucks much more could undoubtedly be accomplished in some lines of work than with horses, but "with the amount of snow to be cared for during a usual winter it is probable that the department will never be able to do without horses."

The expenditures for street maintenance during the year 1919 totaled $103,144, of which the largest item was $22,096 for street and road repairs, and the next largest item was $17,965 for cleaning streets. All the other items were under

$10,000 each. Cleaning streets includes the work of patrol men on the principal paved streets in all sections of the city, one point so cleaned being three miles from the city hall. The collecting and removal of leaves in the fall months is a large item of cost.

An Elgin motor-driven pick-up street sweeper was purchased during the year, the cost of which was charged to the street maintenance appropriation. "The difficulty in securing a competent operator who was willing to stay hindered as successful accomplishment of results as might be possible. This machine does excellent work on smooth pavements and fair work on rough pavements. The early sweeping each morning of the principal retail business streets before much traffic started aided the patrolmen in keeping the streets cleaned."

For some years past a trolley street sprinkler and flusher was used at a cost to the city of about $4,000 a year. This was, of course, limited to the streets having car tracks and was somewhat objectionable when there was much traffic on the street, and Mr. Hartwell decided to discontinue this service and instead use the Elgin sweeper to supplement the work of the patrolmen. This plan has been so satisfactory that there has been no complaint from dust on the paved streets even though very little water has been used for sprinkling.

Says Mr. Hartwell, "I believe that the time is not very distant when work of the patrolmen and the Elgin sweeper should be supplemented with a motor-driven flusher. I say supplemented, for I believe that all street dirt so far as possible should be picked up from the street surface and not flushed into the catch basins. The cleaning of catch basins is an expensive matter and such work should be minimized."

Prior to 1919, dust laying had been paid for partly by assessments levied on the abutters, but last year the council decided to have all watering and oiling done wholly at the expense of the general public, and also to eliminate use of water for dust laying almost entirely, using oil instead. It is concluded from the experience of this city that oil is much preferable to water for laying dust; that making two applications during an ordinary season not only keeps the dust laid but also is a substantial aid in keeping streets in repair, as the oil prevents a large amount of the erosion in times of heavy rain. Twenty tank cars of oil were purchased and applied during the season. The total cost of oiling was $10,600.

Sidewalks are constructed by the city and one-half the cost levied against the abutting property. The general policy last year was to use cement for walks on streets where there is little grade and tar compound on streets having steep grades and also for extensions of walks already built of that material. The sidewalks are maintained by the city, the average amount expended annually for ten years preceding the war having been $5,500. In 1919, the amount spent for this purpose was $6,431, but the average amount for the three years previous had been only $2,400. Mr. Hartwell advocates the spending of more money in keeping the sidewalks in good condition, believing that "it is much better to do a liberal amount of work of this nature as may be needed, rather than through neglect to be compelled to settle damage claims. The money spent in settling claims would much better be expended on sidewalk repairs and everybody would be more saisfied."

State Sues Jersey City for Water Used

The Court of Errors and Appeals of New Jersey has sustained a judgment of the Supreme Court for $22,885 obtained by the State against Jersey City for the use of water between the years 1912 and 1918 in excess of that which it had a right to use. The city claimed that it had obtained from the East Jersey Water Company the right to divert 50,000,000 gallons daily from the Rockaway river and that therefore there could be no recovery by the state until it had exceeded that amount. The court held, however, that there had been no evidence to show that the state had authorized the East Jersey Water Company to divert this amount and that consequently the company could not transfer that right to the city. This judgment was obtained under the act of 1907, which permitted the state to impose a license fee of not less than $1 per million gallons of water diverted by municipalities in excess of the amount that was being legally diverted at that time, which amount in the case of Jersey City was said to be 38,400,000 gallons a day.

Two days after this decision, the State Board of Conservation and Development granted to the borough of Wharton, N. J., permission to divert water from the Rockaway river for the public supply of the borough. The conditions made by the State Board of Conservation were that the borough pay to the state the license fee provided by law and that it divert not more than 500,000 gallons a day.

Safety of Proposed Seattle Reservoir Questioned

The city of Seattle, Washington, having announced that it proposes to construct a storage reservoir in a park on Capital Hill, north of the present reservoir, residents in the lands below the proposed site have begun court proceedings to prevent this because of the danger to life and property which they claim such construction would create. Professor Louis Carpenter, of the University of Colorado, after examining the site, testified that he found on the site of the proposed reservoir a clay and gravel formation saturated with water and giving abundant evidences of springs on the hillside; also that there was evidence of work of burrowing animals. In view of these conditions he considered that it would be unsafe to construct the reservoir at the site selected.

The St. Louis Sewer System[*]

By W. W. Horner[†]

History of the development of the system during about seventy years. Present problem is relief of old trunk sewers. Early run-off formulas are not now satisfactory. The cost of sewerage per acre has been steadily decreasing for fifty years past.

St. Louis was founded (about 150 years ago) on a sloping hillside, and the early city was only about four blocks deep and extended along the river. Its rainfall was carried off in the gutters, and was first enclosed in sewers across the levee, which was the scene of the city's most important development.

Back of this river front slope, the present city lies in a series of valleys, generally trending from west to east, and now includes a large part of the River des Peres valley, which circles the city on the southwest. As the city grew it spread westward up these valleys. This situation was of great advantage for the builders of the earlier part of our sewer system, as it was only necessary to sewer each valley to the extent of the city's development at that time, and the upper ends of the valleys being always rural, presenting no sanitary problem, and yielding comparatively small storm floods, permitted our development under almost ideal conditions. Thus for nearly fifty years our construction was a steady westwardly progress, paralleling the growth of the city, and each additional mile of main sewer indicating distinctly the progressive development in the art of sewer construction.

These early sewers were of two kinds—main trunk sewers, being built almost entirely of cut stone, with some examples of cut stone side walls, and brick arches. In soft ground, these had timber bottoms of extraordinary construction, in some cases consisting of twelve by thirty inch cottonwood logs thirty feet long, laid side by side. The smaller sewers were at first all built of brick, generally of an egg shape in the smallest sections, and circular in the larger ones. The minimum size of brick sewer was three feet high by two feet wide, and the greater part of our old city, east of Jefferson avenue, had sewers of this character, being two by three brick to the extreme ends. About 1870 some cement pipe was used, in sizes from twelve to twenty-four inches. This was discontinued about 1875 in favor of tile pipe, and the tile was used in increasingly larger sizes up to the present time, when thirty-inch is common, and thirty-six inch used.

Eventually, however, we have had to pay the penalty for our earlier advantage of progressive construction. Our progress reached the heads of the valleys and they were completely occupied. They were also completely sewered, but the systems were not comprised in a single engineering design as we would lay them out to-day. Instead, near the river in each valley there were old sewers, inadequate in size and flimsy in construction, and at the upper end modern sewers built, both as to capacity and strength, according to the best standards that we have been able to develop. The intermediate construction represented the gradual progress of the art of sewer design and building throughout the city's development. In the central portion of the city our progress passed over the ends of these eastern valleys into the valley of the River des Peres, and without providing any great improvement for that stream itself, we have sewered in detail much of the River des Peres valley out to our western limits. In the northwestern and southwestern parts of the city our development has now reached to the city limits, and is only now requiring the final sewering of these outlying districts.

Under these circumstances it is obvious that the great problem of sewer work today is the relief of the early trunk sewers and the east ends of the mains in each valley. A study of one of these systems would show portions based on widely different theories of design, and with the personalities of many city engineers and designers impressed on them. Some interesting records of engineering opinion along this line are preserved in the early reports. In 1852 the city engineer said, "I have constantly urged the reduction of our common sewers. I regret to see that private drains are generally made too large, and in midsummer I apprehend that they will be found unclean. It should be borne in mind that small sewers are stronger, cheaper, and more likely to keep clean. It is true they might be made too small, but we have in no instance so reduced the dimensions as to come below ample capacity. I have much reduced the size of the Seventh street sewer, but not until I had carefully observed the quantity of water and calculated the capacity of a sewer requisite to issue such a flood." He then goes on to explain at length the mathematical formula resulting from the study of the mechanics of flow. He ends by saying that "public anxiety may therefore rest assured that if sewers fail it will not be in consequence of their being made too small." It is interesting to note, however, that the engineer failed to visualize the city which was ultimately to be served, and most of his sewers have now from thirty to forty per cent of the required capacity.

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[*] Slightly abbreviated from a paper before the American Society for Municipal Improvements

[†] Chief engineer, Division of Sewers & Paving, St. Louis

During a later development, Mr. Robert Moore evolved a new table for sewer design, in which the sewers were to carry off one inch of water per hour, and at no time to run over three-fourths full. He says, "This is equal to a natural rainfall of two to three inches per hour, depending upon the declivity and the character of the soil." Compare this with our present design, providing for a runoff of from two to three inches an hour.

At a still later date, Mr. Robert McMath made careful gaugings of the flow of the St. Louis sewers, and developed the now famous "McMath Formula," which represented a great advance in sewer engineering, but which we have again been forced to discard in favor of the more satisfactory "Rational Method."

About 1885 the overcharge of the early sewers began to cause serious damage, and supplemental sewers were built in what is now the business district. In 1900 and in 1904 enlargements of the two main valley sewers, that is, the Mill creek and the Rocky branch, were carried out, but gave only temporary relief, and in 1910 and 1914 paralleling sewers were constructed to bring the total main trunk capacity up to the amount required under modern conditions.

In all of this later work there has also been a general change in the character of the materials of construction, concrete and reinforced concrete coming into use for large sections, making possible the carrying out of great projects at half the cost of the old massive masonry structures. The reinforced concrete sewers of the Harlem Creek system were probably the first extremely large sewers in the country, and the Harlem system, as a whole, probably still stands as the largest single reinforced concrete sewer, its sizes being from twenty-nine feet in horizontal diameter down to twelve, and the total length of the system in excess of seven miles.

The sewer problem in St. Louis, while complicated in detail, is fortunate in the absence of any disposal problem. The low water flow of the Mississippi river is forty thousand cubic feet per second, or over fifty cubic feet per second for each thousand of population at present The problem, therefore, is one of handling enormous amounts of storm water, and of carrying the sewage in the same conduits without creating offence. This can be appreciated from the capacities of the Harlem creek sewer and of the relieved Mill creek sewer, which in each valley will carry five thousand cubic feet per second. At the present time we are asking for funds to continue the enlargement of the earlier sewers, and to replace some of the original brick sewers which are now in dangerous condition. A bond issue of two and a half million for this purpose failed to carry this year by a very small margin, and undoubtedly an issue for a larger amount will be voted shortly.

Our problem of sanitation of the River des Peres valley is the largest and most complicated which we have yet had to solve, and any satisfactory solution involves very great expenditures. The flow of this stream in full flood exceeds the low water flow of the Mississippi river, and portions of the stream, which it seems necessary to carry in conduit, will have a flood flow of fully ten thousand feet per second. The plans for the work are complete and work will undoubtedly be begun in the next three years. The estimated cost of the whole project is $14,000,000.

The cost of our sewers has from the beginning been divided between the general public funds in the construction of public sewers, and the individual property holders in assessment by special tax. District sewers were paid for by bond issue guaranteed by the city, and refunded from the special annual tax, not exceeding fifty cents on the hundred dollar valuation. At a later date this was amended, and special tax bills for the full amount of the contract were issued to the contractor for collection. This latter system continues today, and while it absolves the city from any responsibility in its payment, it also makes the issue of tax bills particularly liable to contest and litigation, and their value has, therefore, considerably depreciated. A return to the earlier system, or of special tax bonds, would be an advantage.

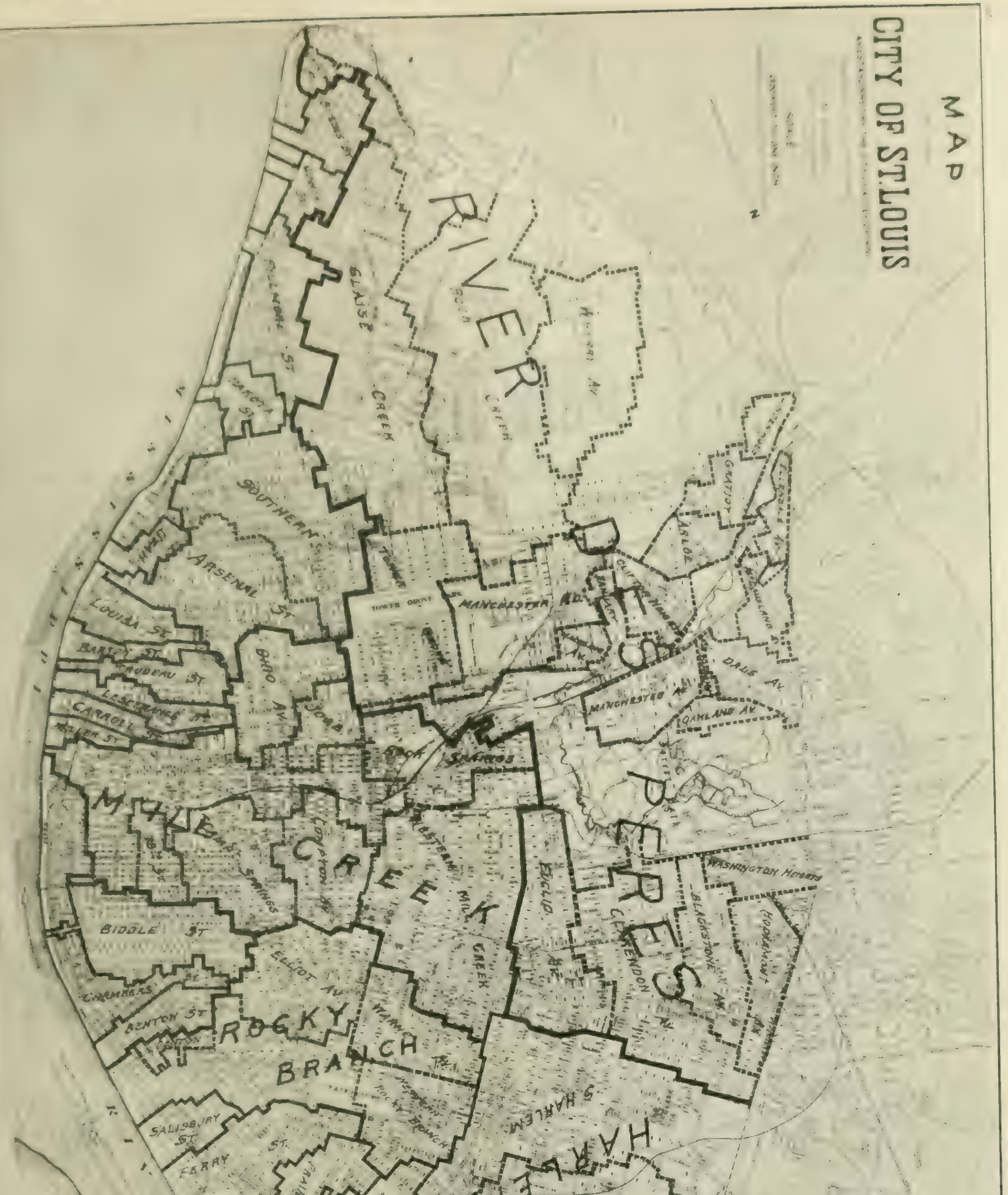
The growth of the system, together with its cost, is shown in the following table. Of the area within the present city limits, 64 per cent is now completely sewered, and an additional 12 per cent is provided with main sewers. Of the 23 per cent unsewered, about 5 per cent is in parks, so it will be seen that the city is in a very satisfactory sanitary condition, our one great problem, as mentioned before, being the sanitation of the River des Peres valley.

Of the total cost of the sewer system to date 31 per cent has been paid from public funds, and the remainder taxed directly against the property.

TABLE I.

Year	Acres	Miles	Cost	Cost per acre
1855	400	18	$525,000	1310
1877	3720	180	$5,185,000	1390
1899	11,530	487	$9,248,400	802
1920	23,700	878	$23,512,000	990

The figures of cost per acre for sewerage are interesting in showing a steady decrease throughout the seventy years of the system's existence. The value for 1877, $1,390 per acre, is probably unbalanced, due to the fact that it came at the end of a period of very heavy main sewer construction, with a comparatively small acreage chargeable. Of the cost of the system to date, that is, $23,512,000, nearly five million dollars is chargeable to relief sewers, with which there was no corresponding additional acreage. If no relief sewers had been built, the cost per acre would now average less than $800. This simply means that with the demand for increased service, with the provision of greater capacities and more closely built areas, we have still been able to decrease our unit cost by the introduction of modern economical methods. These decreases are undoubtedly due primarily to the use of mechanical excavators, to the introduction of reinforced concrete in large sewers, and to the decrease, up to 1916, in the cost of factory made materials.



MAP OF THE CITY OF ST. LOUIS, SHOWING THE RIVER DES PERES AND OTHER SEWER DISTRICTS.

Water Supply for Private Land Development

A proposition has been made to the city council of Wilmington, N. C., by a land development company, that the company lay a distribution system through its property, to be connected to the city mains, and that the city collect the lawful water rates and turn them over semi-annually to the company until it has been reimbursed for the expense of constructing the system. In other words, the company would furnish the funds for laying the mains, and the city would purchase them by turning over to the company the water rents collected from the consumers along such mains.

This is a variation from the method which we believe is more common of having the mains laid by the city or water company, a certain annual percentage of the cost of such construction being guaranteed by the development company, which would furnish the balance, if any, between such annual rate and the regular water rates collected.

Hydro-Electric Power in Canada

Reference was made in a previous issue of PUBLIC WORKS to the attention being paid to the development of hydro-electric power in France and England as well as in this country. A recent report from Canada states that that country possesses the greatest per capita water power development of any in the world except Norway, having 19,500,000 horse power available, with a per capita development of 0.26 h. p., as compared with 0.54 h. p. for Norway and 0.07 h. p. for the United States.

In general, Canadian water powers are applied to three uses—municipal purposes, manufacture of pulp and paper, and electro-chemical and similar processes. Of the developed water power about 78 per cent is used for municipal, 14 for pulp and paper and 8 for electro-chemical or similar processes.

Locks and Dams for Sacramento Valley

The Sacramento Valley Development Association has decided to ask Congress to investigate the project of building canals and dams on the lower Sacramento river to serve three or more purposes, namely, to conserve and store water for irrigation, to prevent the tidal backing up of salt water to points where the stream is used for irrigation purposes, and to improve the navigation possibilities of the river.

Captain E. S. Jarvis, United States Army, suggested either a barrier across the Carquinez straits, or a dam across the bay from Port Richmond, estimating that the former would cost about $15,000,000, and would make it possible to store 800,000 acre-feet of water. All of those interested in the commerce and agriculture of this valley seem to agree that something is needed to improve both navigation and irrigation conditions, and the general scheme outlined seems to be the most feasible one suggested. The scheme is a large one however and will probably have to make progress somewhat slowly.

Reference has previously been made to a proposition by Robert B. Marshall that the state legislature appropriate a half million dollars for a preliminary survey and investigation of the water courses of the state with a view to formulating a fundamental state plan of water storage and distribution, which we believe is intended to include the Sacramento valley improvement above referred to.

Snow Plows for Massachusetts Roads

The highway division of the Massachusetts Department of Public Works, which will have charge of keeping open the highways of the state during the coming winter, has put it up to the truck owners to co-operate with the department if they wish to be able to use the roads continuously during the snowy season. The department has purchased 60 snow plows for use with heavy trucks and has secured fittings for attaching these plows to trucks of several different makes, but it looks to truck owners and freight shippers to operate the plows. The legislature appropriated $50,000 to the department for keeping open the roads, and it is apparent that this sum is by no means sufficient for furnishing and operating the trucks required for this work.

In addition to furnishing the plows, the state department will provide engineers to assist in arranging the work and supervising it when the actual plowing begins. Commissioner Cole has asked the truck users and owners of the state to notify him how many trucks they are prepared to supply for this purpose. Unless this is done and trucks are definitely assigned for each section of road beforehand and prepared to have the plows adjusted to them on short notice, there will be confusion when the snow arrives which must result in delay and probably greatly increase the difficulty of the work.

Missouri Good Roads Campaign

A caravan of army and navy trucks is touring Missouri with speakers that are urging the proposed $60,000,000 State bond issue for the construction of 6,000 miles of hard surface road without affecting taxes. The party contains a number of promient men of all political affiliations and is met with enthusiasm all along the route. The speakers are supplemented by moving pictures of road building in Missouri and by the American Army in France, and it is explained that the present yearly income of about seven dollars each for 300,000 automobile licenses in the state will suffice to take care of the interest on the bonds and that the reasonable increase of automobiles, which has been 125 per cent in the last year, may be expected soon to insure a net income of $3,500,000, which will be sufficient to retire the bonds and provide maintenance for the road.

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Deliver Materials Now For Next Years Work

In two of our recent articles describing road construction it was stated definitely that the rapidity of the work was due in part to absence of interruption caused by delay in receipt of materials, these having been delivered on the ground before construction began and drawn upon as a reserve. It is probable that a number of other instances where work was carried on with a rapidity and profit to the contractor this year, the ability to draw upon a reserve pile of stone, gravel, sand, cement and other materials played a very important part. These contractors were fortunate in being able to make their contracts sufficiently in advance of the construction season to permit utilizing the interval by obtaining and delivering on the work a part at least of the materials that would be required.

A year ago, we strongly recommended that the winter months be utilized in getting on the grounds such materials as it was practicable to obtain and deliver, and many contractors did this. One of the arguments in its favor was that the freight service of the railroads was most congested in the summer and least so in the winter and early spring, and that the contractors could therefore obtain better service from the railroads in having their materials delivered by utilizing this slack period. Unfortunately for many of the contractors, the condition which had prevailed during the season referred to before the war did not recur last spring, but, owing to shortage of open-top cars and unusual necessity for their use, in several sections of the country it was practically impossible for contractors to obtain any service of this kind from the railroads. It is to be hoped that they and others will not be discouraged this year by that experience. It is announced positively by many railroads that freight traffic is already slowing up and that their transportation equipment is fairly adequate for present needs and that a few weeks will find idle cars on the siding. In other words, so far as this condition is concerned, the railroad traffic is becoming more nearly normal and the condition anticipated for last year will actually exist this year.

In view of the advantage actually enjoyed by those contractors who were able to secure the early delivery of construction materials for this season's work and of the promise that railroad facilities will be such as to permit contractors in all sections of the country to adopt the same far-sighted policy, there would seem to be no question that every contractor who can obtain his contracts and arrange his work so as to do this, should begin delivery of materials early in the year of 1921.

This, of course, necessitates the securing of contracts not later than sometime in January, and this again involves the calling for bids for such work within the next few weeks. Officials of highway and other state and city departments will therefore be aiding greatly in insuring the completion of next year's construction program by at once preparing such a program and calling for bids upon it,

Licensing Engineers

The licensing of engineers by states appears to have become an established policy in this country. Only a few years ago there was considerable discussion and difference of opinion among engineers, and in engineering societies, as to the advisability of such licensing, and presumably such difference of opinion continues. But the fact that a dozen states already have laws requiring the licensing of engineers and architects seems to make it necessary for the other states to fall in line or else in all probability engineers who cannot qualify for licenses in states where such are required will move into those states where licenses are not required; and if licenses are refused only to the incompetent, as they are intended to be, such results would be unfortunate for the non-licensing states.

This being the case, it is desirable that the license laws shall be the best possible from the point of view of both the public and the engineers. The Ohio engineers are, we believe, correct in thinking that a better law from the public's point of view, as well as from their own, can be prepared by engineers than could be prepared by lawyers or other non-technical men. Acting on this opinion, the Ohio engineers have drawn up a draft of a bill which it proposes to submit to the next legislature. The main features of this draft are given in this issue, and we recommend them for consideration by engineers and engineering societies in other states which have yet to adopt licensing laws.

Engineering Services by State Officials

The engineering division of the Illinois Department of Public Health "does not attempt to take the place of a consulting engineer but, on the other hand, always encourages the employment of competent consulting engineers by communities and then endeavors to assist the engineer in so far as its authority and duties will permit." This quotation from a circular recently issued by the Illinois Health Department has probably been called for by criticism which has been directed at health departments and many other state departments in the various states having supervision over engineering constructions and operations, that the engineers employed by the state perform gratuitously work which the engineers of the state in private practice rely upon for their incomes. It is a very nice question of ethics in the profession and of what is most for the public benefit. It unquestionably is not fair to practicing engineers that their practice should be destroyed by services rendered by public officials. On the other hand, it is to the vital interests of the public that supervision by competent state officials should be had over certain branches of engineering work, such as sewerage and water supply, which vitally affect the health of the people. The duty of a health department would, therefore, appear to be that expressed in the report just quoted from (which is abstracted in this issue), to stimulate public action to the point of employing competent engineers to do the work, and to pass upon the engineering, designing and construction work with a view solely to preventing the squandering of public money or the failure of such works to perform their desired function of preserving the public health.

Even more interference with the business of the private engineering practitioner is occasioned by professors in engineering schools doing private work of exactly the kind which is performed by engineers who make this their sole business. Possibly there could be little just criticism of this if the engineers who teach were not inclined to "cut rates" because they obtain a considerable part of their income from their college services. Certainly, whether or not it is proper for them to engage in private engineering practice at all, they should not compete with other engineers unfairly, offering their services at anything but the rates which the highest class of services is entitled to. From the point of view of the students in their classes, there is the further question of whether their private practice may not interfere with the full performance of their college duties. Some colleges encourage their professors to take on more or less private practice, believing that this keeps them in touch with practical affairs and prevents their settling down into old ruts, some colleges going so far as to employ part of the time of practicing engineers for instruction of their engineering classes. On the other hand, at least one or two colleges forbid their professors engaging in private practice at all. The question is a difficult one for solution so as to secure the best interests of all concerned. In this case, the public would not appear to be especially interested, but it is largely one of ethics of the profession, and as such would seem to be entitled to more consideration than has been given it by the various codes of ethics which have been prepared and promulgated from time to time by individuals and organizations.

Registration of Ohio Engineers and Architects

A committee of engineers of that state has drafted a bill and hopes to obtain the endorsement of it by all the state organizations concerned and to have it passed by the next legislature.

The matter of registering engineers, which was being advocated by a few some eight or ten years ago, has now become a reality in quite a number of the states and is rapidly being adopted in others. Information concerning such developments in Virginia and North Carolina were noted in our issue of October 30. Ohio engineers are expecting to obtain similar registration laws in that state next year. In preparation for it, some of the organizations of engineers in that state have, through a committee, prepared a draft of a bill which is being submitted to all of the engineering, architectural and technical societies in the state. This committee was originally appointed by Cecil L. Rood, as president of the Ohio Engineering Society, adopted by the Association of Ohio Technical Societies and endorsed by the Ohio Assembly of the American Association of Engineers. The tentative bill may therefore be considered as the proposal of those organizations, and copies have been sent to all other known organizations interested, with a request that they either endorse it or notify the committee of such changes as they think absolutely necessary and appoint a delegate fully instructed to meet some time in November to perfect a final draft.

In its report the committee says: "The issue has been put squarely up to us by the enactment of similar legislation by numerous other states and the virtual barring out of Ohio engineers from at least one other state until such a law is passed." Another argument for the law is that men are elected county surveyors who do not even pretend to be engineers and yet have charge of bridges and highways. Such legislation will undoubtedly come in Ohio and the committee believes it wise to have it prepared by engineers and architects and fully discussed by technical societies, "rather than to take a chance on such laws as may be drafted by non-technical men." The bill covers both engineering and architecture, because "there is so much inevitable overlapping between these professions, and between the various branches of engineering, that most annoying and damaging complications cannot fail to follow attempts at separate regulation. This has been demonstrated in Illinois."

The bill provides that, beginning one year after its passage, it shall be unlawful for anyone to practice professional engineering, architecture or surveying, or to hold public office or employment involving the practice of such professions, or to set or disturb boundary monuments, unless such person regularly hold a certificate entitling him to practice professional engineering, architecture or surveying. A person holding an engineering certificate can practice architecture, and vice-versa, but a surveyor's certificate does not include the other two. Such certificate is necessary to permit a person to qualify as expert witness on these subjects in any Ohio court, and no map or plat of any land or mine will be accepted for record unless certified by a registered engineer or surveyor.

In the case of a corporation or partnership practicing engineering, architecture or surveying, all persons connected with it in responsible charge of design or supervision of work must be registered. Assistants not having responsible charge of work are not required to hold certificates providing they report directly to a registered engineer or architect who assumes all responsibility for their work. A person must be a citizen of the United States or Canada, or have made declaration of his intention to become a citizen of the United States, in order to receive a certificate.

The committee recognized that a satisfactory definition of the practice of engineering and architecture is practically impossible, but anticipated that the first attempt to enforce the bill would almost inevitably lead to a definition prepared by persons much less competent to do so than are the members of the technical professions; consequently it seems best to prepare such a definition, making it the best that the combined abilities of the engineers of the state can prepare, rather than leave it to the courts to make such definition. The definition given in the tentative form for the bill is as follows:

> Professional engineering, architecture and surveying within the meaning of this act embrace and include all branches of the professions of engineering, architecture and surveying, other than military engineering. Any person who assumes responsible charge in the design or preparation of drawings for any building, bridge, railroad, harbor, canal, dock, dam, waterway, street, highway, sewer, sewage disposal plant, water works, water supply, drainage system, mine, tunnel, dry dock, ship barge, dredge, crane or other floating property, steam engine, turbine, internal combustion engine, or other mechanical apparatus, electrical machinery and apparatus, works for the development, generation, transmission, or application of power, equipment or structures for carrying out mining and chemical operations, refrigerating, heating, or ventilating apparatus or structures, or other works of similar nature which require for their design experience and technical knowledge, or who makes estimates or specifications therefor, or who directs the construction of such works as engineer or architect, or who acts as a consulting engineer or architect, or who surveys or makes maps or plats of any county, township, city, village or of any land, road, lot, sub-division or addition or of any mine, tunnel, stream, or body of water, or who does any work ordinarily known as civil, mining, mechanical, electrical, illuminating, chemical, metallurgical, ceramic, refrigeration, ventilation, heating, automotive, valuation, municipal, highway, railroad, structural, hydraulic, sanitary, irrigation or drainage engineering,, architecture, or marine architecture, landscape engineering or architecture or surveying except on his own property, for his own personal use and without receiving money therefor, or who offers or agrees to do any of the above things, or maintains a place of business for the carrying on of any of the branches of the engineering or architectural professions or surveying, shall be regarded as practicing professional engineering, architecture or surveying within the meaning of this act. Any person doing any of the things specified in this section with authority to use discretion, assume responsibility, and devise methods shall be regarded as practicing professional engineering or architecture within the meaning of this act, even though he be employed by or under the direction of a registered professional engineer or architect.

A fee of $10 is provided for consideration of an application and $25 for the examination of an applicant, with $1 for each certified copy of a certificate.

The making of the examinations and granting of certificates will be the duty of a board appointed by the governor with the consent of the senate. This board will contain eight members, appointed for four years, the terms of four expiring every two years. These members must be registered professional engineers, architects or surveyors, there being at least three professional engineers and three architects, with not more than one member from the same branch of the profession of engineering. Each member must have been for at least five years a citizen of Ohio and continuously engaged for at least ten years in the active practice of one of the three professions or in teaching such profession in a reputable college, not more than one teacher to be a member of the board at any time. No member of the board will receive compensation except the secretary. The affirmative vote of not less than five members will be required to issue or revoke a certificate, and these five shall include a majority of the architectural members for an architect's certificate or the majority of the engineer members for an engineer's or surveyor's certificate. The board may issue certificates without examination to persons holding similar certificates from other states or territories. Any one obtaining such a certificate by fraud or who fraudulently pretends to own such certificate shall be subject to a fine of between $100 and $1,000 or imprisonment between thirty days and one year, or both; while any one practicing engineering, architecture or surveying without a certificate shall be subject to a fine of from $20 to $500, imprisonment between thirty days and one year, or both.

Paving Specifications by Pavement Associations

The Asphalt Association and the National Paving Brick Manufacturers' Association have prepared and published for distribution and use complete sets of specifications, including sub-base, base of macadam, cement and bituminous concrete, and wearing surfaces of brick, asphalt macadam, asphalt concrete and sheet asphalt.

Within the past few days there have been received at this office a complete set of specifications for laying brick pavement, published by the National Paving Brick Manufacturers' Association, and a notice by the Asphalt Association of the publication by it of specifications for the various kinds of pavement using asphalt as a binding material. Both of these associations, while they are maintained by and for the benefit of manufacturers of paving materials, are concerned very largely with insuring the use of such materials in the way which will give the most satisfactory results and thus serve as an advertisement of the material, and it may be assumed therefore that the specifications can be relied upon as calculated to give the best pavements obtainable with the particular materials under discussion.

ASPHALT SPECIFICATIONS

The asphalt specifications are issued in a series of five different parts, dealing, respectively, with asphalt macadam surface course, asphaltic concrete surface course with coarse graded aggregate, asphaltic concrete surface course with fine graded aggregate, sheet asphalt binder and surface course, and asphaltic base. In addition, the association has issued specifications in mimeograph form dealing with asphaltic concrete binder and surface course; gravel base; macadam base; reconstruction of old macadam to serve as base course; Telford base; Portland cement concrete base; truing up old pavements to serve as base course; preparation of sub-grade; sub-base; and shoulders, headers, curbs and gutters. In the preparation of the first five specifications, special attention has been paid to form and arrangement, with the idea of making them definite, concise and free from ambiguities. They are printed on single fold sheets of the size adopted for this purpose by the U. S. Bureau of Public Roads, most of the state highway commissions, and many municipalities.

"During the preparation of these specifications the committee had before it the specifications of every state highway department in the United States as well as those of a large number of the principal counties and cities and of the United States Bureau of Public Roads. The opinions of many prominent highway engineers were obtained and digested. The committee, with Mr. Prevost Hubbard, formerly chief of the Division of Tests and Research of the United States Bureau of Public Roads as chairman, was composed of engineers having long practical experience upon highway and pavement construction and design. In order to make them applicable to varying conditions throughout the United States, each printed specification is accompanied by a notice to engineers which will assist the engineer in modifying it if necessary to meet his particular requirements." We suppose that these specifications may be had upon request of the association, 25 West 43rd street, New York City.

Some of the fundamental features of these specifications are:

For asphalt macadam surface course, a minimum thickness of 2½ inches using 1½ to 2½-inch crushed stone and asphalt of 80 to 150 penetration.

Asphaltic concrete surface course with a thickness of 2 inches consisting of a coarse aggregate 95 per cent of which will pass a 1¼-inch screen for the coarse graded aggregate type, or a ½-inch screen for the fine graded aggregate, 4 to 6 per cent of filler for the coarse aggregate type and 7 to 11 per cent for the fine aggregate; and 5 to 8 per cent of asphalt for the coarse and 7.5 to 9.5 for the fine, the asphalt to have a penetration of 50 to 70.

Sheet asphalt binder and surface course each to have a thickness of 1½ inches, the binder course to have 60 to 80 per cent coarse aggregate, 4 to 6 per cent of bitumen, asphalt cement for both courses to have a penetration of 30 to 60. The surface course to have 10 to 40 per cent of 10-mesh to 40-mesh material, 22 to 45 per cent of 40 to 80-mesh, 12 to 30 per cent of 80-mesh to 200-mesh, and 10 to 20 per cent passing 200-mesh; with 9.5 to 12 per cent bitumen.

Asphalt base to consist of two courses, the first 3½ inches thick and the second 2½ inches, the first containing 2½ to 3½-inch stone and the second 1¼ to 2½-inch; one application of asphalt at the rate of 1.25 to 1.5 gallons per square yard to be made upon each course and the second course covered with thin layer of ¾ to 1¼-inch stone.

The asphaltic concrete binder and surface courses consist of a 1½-inch course of fine graded aggregate asphaltic concrete wearing surface as specified above, laid over a 1½-inch binder course as specified above.

The specifications for the several constructions of base call for two courses of gravel each not less than 4 inches thick; for two courses of macadam each not less than 3 inches thick; for the reconstruction of old macadam giving a minimum thickness of 6 inches after completion; for hand-laid 8-inch Telford base, or for a 6-inch Portland cement base mixed 1:3:6.

The specifications for truing up old pavements provide for the use of an asphaltic concrete mixture for this purpose. The specifications named last in the list provide for gravel, water-bound and asphalt macadam shoulders, Portland cement concrete headers, curbs and gutters.

BRICK PAVEMENTS

The specifications for brick pavements are printed in a handsome pamphlet of 200 pages, profusely illustrated with photographs showing the various features of constructing brick pavements. Alternate methods of construction and kinds and variations of material are provided for in the specifications. For instance, specifications cover rolled gravel base, rolled stone base, rolled slag base, stone or slag base with coal-tar binder, concrete base, monolithic type, and reconstructed macadam, gravel or concrete base. Sand bed, stone screenings or granulated slag bedding, or cement-sand bedding (semi-monolithic type), are all specified. Specifications are given for standard size brick and block size brick, both plain wire-cut and the block size with lugs. For joint fillers the alternative is offered of oil asphalt applied by the squeegee method, cement grout, or sand filler. For longitudinal expansion joint (called expansion cushion), both the pre-molded and the poured type are specified.

The specifications include sections for underdraining and grading the sub-grade, mixing and placing concrete as well as testing the materials that enter into it, setting the curbs and headers, both concrete and stone, preparing the base, and all the regular features of brick pavement construction.

The longitudinal expansion cushion is called for only where cement grout filler is used. The pre-molded strips are to be ½ inch thick, and the same thickness is used for the poured cushion. Fully one-half of the specifications are devoted to the base and shoulders of the pavements, which are included under the same heading and for which twelve alternative classes of material and treatment are provided.

The standard size brick is 3 inches by 4 inches by 8½ inches, from which they must not vary more than ⅛ inch in width or depth nor ½ inch in length. The block size is 3½ inches by 4 inches by 8½ inches, with the same limits of variation. Blocks with lugs are 3½ inches by 8½ inches by a depth left unfixed. In the case of the plain wire-cut brick or block, it is provided that brick shall be laid "with the better face or side upward"; this apparently providing for the so-called vertical fiber pavement as well as for the ordinary method of laying.

No advice is given as to the selection of any of the alternatives offered, but the specifications are provided to cover the several types and details of construction which may be preferred by the engineers or be best adapted to local conditions.

Recent Developments in Brick Paving

In a discussion before the American Society for Municipal Improvements, J. C. Travilla, engineer of the Dunn Wire-Cut Lug Brick Co., criticizes some of the changes advocated by brick manufacturers as to lugs, size of brick, and thickness of foundation, and makes suggestions concerning filler, cushion and expansion joints.

Some of the recent developments in brick paving and paving bricks, which were submitted last year to the specifications committee of the A. S. M. I. but not formally acted upon, were discussed at this year's convention of that society by James C. Travilla, consulting engineer of the Dunn Wire-Cut Lug Brick Company and for several years commissioner of streets of St. Louis, Mo. He states that the high cost of brick caused by recent conditions as to labor, materials and transportation has caused some unrest among certain manufacturers, which may be one of the reasons why the National Paving Brick Manufacturers' Association at the 1919 meeting of the A. S. M. I., requested certain amendments to the brick specifications.

"The brick manufacturers, due possibly to lack of co-operation or co-ordination of the industry by limiting the production to a few types of brick, are reported as having twelve different styles of brick for street and highway surfaces." The engineering organizations which have been studying and developing paving specifications have recommended but two types of brick for pavements, and these have been adopted by municipal and state highway engineers generally. "The brick manufacturers should realize that they are merchandising their plant output through engineers who represent the taxpayers, and that any request to change the size and types of brick and amend specifications to meet changed commercial and economic conditions that affect the industry should be based on definite technical information proved by experience." Mr. Travilla recognized the need of variation in the designs and specifications for pavements depending upon local conditions, but questioned the advisability of attempting to adopt them as standards.

LUGS

The author traces the history of paving brick from the original plain wire-cut brick of 1870 through the various changes. With the introduction of tar or cement fillers came the repressed brick, which was provided with buttons or other projections on the sides to provide a definite and positive joint space to permit the filler to flow to the full depth of the brick. These lugs became generally used and adopted as a standard. The rounded edges of repressed brick were found objectionable in maintaining the cement grout filler in the joint flush with the top of the brick; also in repressing, the buttons or projections frequently were deformed so as not to serve their purpose. To eliminate these features, the wire-cut lug brick was introduced in 1910 and has been adopted as one of the standard types by many city engineers and organizations.

"A lugless paving brick has been advanced and promoted on the theory of commercial and economic advantage to the paving industry without due regard to past experience or the engineering features necessary to construct a brick pavement according to the best practice."

Mr. Travilla believed that the advocating of or attempting to adopt a type of brick as a standard that does not insure definite and positive joints is a step backward in the art of making brick and in the science of making brick pavements. His reasons for this are that experience and experiments have demonstrated the necessity for definite joint spacing to admit the filler to penetrate the full depth of the brick; that if a bulge on the end of a lugless brick is desirable to provide spacing, it should be self-evident that a definite joint is required on the side of the brick; and that the abandonment by the manufacturers of their previously advocated policy of using lugs on bricks, at a time when engineers are not in a position to experiment, appears to be a serious mistake. "Fortunately for all parties interested, only a limited number of plants are yet making lugless brick."

SIZE OF BRICK

At the Grand Rapids meeting of the A. S. M. I. in 1911 specifications were adopted for a standard size paving block 3½ inches wide, 4 inches deep and 8½ inches long, with lugs on one side not to exceed ¼ inch in height, and the same was adopted in 1912 by the Association for Standardizing Paving Specifications. Engineers generally have adopted this size and type of brick in their specifications and they are recognized as standard at this time. Any material change in the standard size of a brick would cause inconvenience to engineers in the repairing and maintenance of existing brick pavements and undo a great deal of work that it has taken years to accomplish, such as developing the rattler test.

"The paving brick manufacturers in the West in recent years have established a market for a brick 3 inches in depth known as a vertical fibre brick. The bricks are manufactured with bars on the side to provide spacing for the filler. The 3-inch size of the paving brick has never been standardized by the industry or a national organization and there is no question as to the desirability of adopting a definite standard size and test for both the vertical fibre brick and the wire-cut lug brick. The repressed bricks are not manufactured in the 3-inch size."

FILLER

Refined asphalt for filling joints in vertical fibre brick pavements has been used extensively and the results obtained have varied depending upon the quality of the material, its melting point and the skill used in heating and applying it. Some cities have constructed a bituminous mat on the surface of the pavement by using an excess of asphalt; but asphalt will not adhere to the brick except by mechanical bond, and at times peels off. In applying asphalt by the squeegee method the joints are often bridged over, while pouring the asphalt into the joints insures better penetration and the saving in the amount of asphalt used will more than pay the cost of the additional labor. On pavements carrying a large percentage of horse and steel-tire traffic, the filler will cut out of the top of the joints within a few years and should be renewed—a feature of maintenance which is generally overlooked.

"It may be stated as a general proposition that a bituminous filler is best adapted where the wearing surface is laid upon a new macadam or gravel foundation. The cement grout filler is adapted for use where the sub-grade soil is stable and the design provides for a rigid foundation."

FOUNDATION

"For a national engineering organization, under existing truck traffic and pavement failures that have occurred recently, to consider a reduction in the depth of the concrete foundation to permit the use of a slab less than 6 inches in depth, as suggested by certain interests at the New Orleans meeting in 1919, will not meet with the approval of engineers. However, engineers should be sufficiently informed to modify the design of a foundation recognized as standard to meet local conditions.

"It also seems reasonable to suggest that a differential be allowed for the depth of the concrete foundation depending on whether the filler used is cement grout or bitumen; but again, this suggestion or modification of the specifications should be treated as a local proposition not coming within the scope of a national engineering organization."

CUSHION

Fine cement carrying a small amount of loam or silt has not given entirely satisfactory results because of the tendency of the material when moist to work up into the joint spaces when the brick are rolled, thus preventing the filler from penetrating the full depth of the joint. A coarse sand for the bed drains much better than a fine sand and, when prepared by rolling with a light hand roller to acquire uniform density before striking it with a template, furnishes a bedding course that gives satisfaction.

"Many engineers are using cement and sand mixed, usually 1 cement to 4 sand, spread dry. There seems to be no question but that a greater number of longitudinal cracks appear in a cement grouted brick pavement laid upon a sand bed that does not drain readily than when the bed is a mixture of cement sand."

EXPANSION JOINTS

Engineers differ as to the advisability of expansion joints at fixed intervals in brick pavements when cement grout filler is used. The author of this paper "questions the advisability of attempting to control temperature stresses with transverse joints. A study of pavements with expansion joints would indicate a weakness in the structure at or near the joints, by reason of contraction and expansion stresses destroying the bond between the courses of brick, and a tendency of the pavement to lift at the joints. . . . A large percentage of the blow-ups that have occurred in grouted brick pavements may be attributed to a defective joint in the end of a day's run or at a break in the street grade." The author believes that each paved street intersection in the line of the improvement may be considered a compression header. If a street intersection is not improved, there should be placed at the beginning or ending of the work a concrete header that will have the same effect, i. e., to confine the stresses within the limits of one city block. The pavement should be completely separated at alley entrances and driveways. Manhole frames and castings should be so set as to permit them to move with the pavement; otherwise expansion cushions should be installed around these appurtenances. Longitudinal expansion joints should be placed adjacent to each curb line.

Size of Paving Blocks

In a paper entitled "Bricks vs. Blocks," S. Cameron Corson, Borough Engineer of Norristown, Pa., argued against the use of blocks and in favor of the old standard repressed paving bricks, giving as his reason his personal experience in Norristown. He stated that his borough has been laying brick pavements since 1897 and, although showing signs of wear, these old pavements laid with repressed brick are in excellent condition. On the other hand, pavements laid during recent years of vitrified blocks are being destroyed by longitudinal and transverse cracks, and individual blocks in the middle of the pavement are disintegrating and going to pieces. Mr. Corson believed that the blocks are not so well burned as the bricks and are more likely to be laminated. Broken blocks are found to absorb considerable water and to be not thoroughly burned through.

He also introduced the question of proper thickness for expansion joints. He had found ¾-inch joints reduced to less than one-half that thickness and half of the joint material forced out of the pavement by expansion. He considered that at street intersections with 10-foot radius circular corners, the distance to be used in determining thickness of expansion joints should be the diagonal across corners, and this would be 58 feet for a 36 foot street. The rule used by one agent for pavement filler gave a joint thickness of 3½ inches for each corner or 7 inches in all, which would seem impracticable or at least undesirable.

Massachusetts Highways

At the October 14th meeting of the Massachusetts State Chamber of Commerce John N. Cole, state commissioner of public works, stated that Massachusetts is more dependent on highways than any other state because of the lack of co-ordination and co-operation of railroads and because of the unsystematic terminal facilities of Boston. It is considered an essential of progress and prosperity that the highway system be reconstructed and the toll charges perhaps reestablished in the interest of greater efficiency. This year the state is spending $4,500,000 on highways and has a budget for next year of $7,000,000.

Last year the bids for construction were from 24 to 34 per cent above the unit price estimate, while this year every bid submitted has been below the commission's unit price estimate. An explanation of this fact was illustrated by the replies of two contractors who agreed that it was because of the decreasing cost of labor and materials; one of them, an Italian, stating that "to day I say to the workmen 'you take that pick and dig or I smash your head,' while before when told to work, the laborer replied 'you shut up or I smash your head.'" This was assumed to mean that labor was now getting ready to do a day's work.

An important item of the high cost of highways in Massachusetts is the expense for bridges, less than 10 per cent of which are stated to be adequate for their daily loads, necessitating an expenditure of $30,000,000 for their reconstruction in the near future.

Winter Work on Gravel Roads

Road contractors in Montana have been notified by the State Highway Commission to observe the following conditions in connection with road work during the fall and winter: Preliminary work must be completed long enough before freezing weather to eliminate the handling or movement of frozen earth. Drainage structures and ditches must be complete and in operation before placing surface gravel. Gravel may be hauled during the winter except where such hauling creates cuts or ruts to such an extent as to prevent reshaping. All snow must be removed before placing surface gravel. "Early in the spring, as soon as weather permits, contractors will thoroughly disturb the mass of gravel, by scarifying with a heavy spike-tooth harrow, remove over-size stones and complete work as specified." It is thought probable that considerable gravel hauling will be done this winter under these regulations.

Delaware State Highway Department

Organized under recent legislation, this department has adopted up-to-date methods and policy, after making comparative study of highway departments of other states. Counties receive state and federal aid. The state system provides main north and south highways with transverse connections having unusually straight alignment and avoiding passing through towns.

The state of Delaware is 110 miles long and 35 miles wide and contains 2,370 square miles. The highest point is 60 feet above sea level and the surface is so level that drainage is difficult in many places. The greater part of the soil is sand or sandy clay and there is little rock suitable for paving. For four months of the year there is sufficient low temperature to prevent concreting, but there is little snow. The roads outside of the cities total 3,796 miles, of which, at the beginning of this year, only about 400 miles had been improved, 300 of these being penetration macadam, 90 miles concrete 14 to 18 feet wide and 7 miles brick 19 to 40 feet wide.

Until 1917 there had been no state highway department or state control of highways, althougl a number of progressive citizens had been urging that such be established.

1911 the General Assembly passed the Boulevard Corporation act authorizing a corporation of private citizens to build a state road, which, after completion, was to be conveyed to the state free of cost and the state must forever maintain the road and its bridges, culverts, etc. Under this permissive act the DuPont Boulevard Corporation was formed. A twenty-mile right-of-way between the Maryland line and Georgetown was acquired and a concrete road constructed on it, following which another section of road was begun and, in spite of litigation, was completed in 1917. The road so constructed was formally turned over to the state three months after the formation of the State Highway Department.

STATE HIGHWAY DEPARTMENT CREATED

In 1917 the General Assembly enacted a law creating a State Highway Department to establish a permanent system of highways, with power to take over any existing roads and convert them into state highways.

The department was organized in June, 1917 with Governor Townsend as chairman and four other citizens, including T. Coleman DuPont, who had been president of the DuPont Boulevard Corporation. Chas. M. Upham was employed as chief engineer. Mr. Upham had been chief engineer of the DuPont Boulevard Corporation for two years and met the requirements of the law that the chief engineer must be a civil engineer at least 30 years ıld who has been in active practice of his profes-ion for ten years and has had responsible charge f road engineering work for 5 years and be ıualified to design as well as to direct engineering vork. Graduation from a recognized school of engineering is considered equivalent to two years of actual practice.

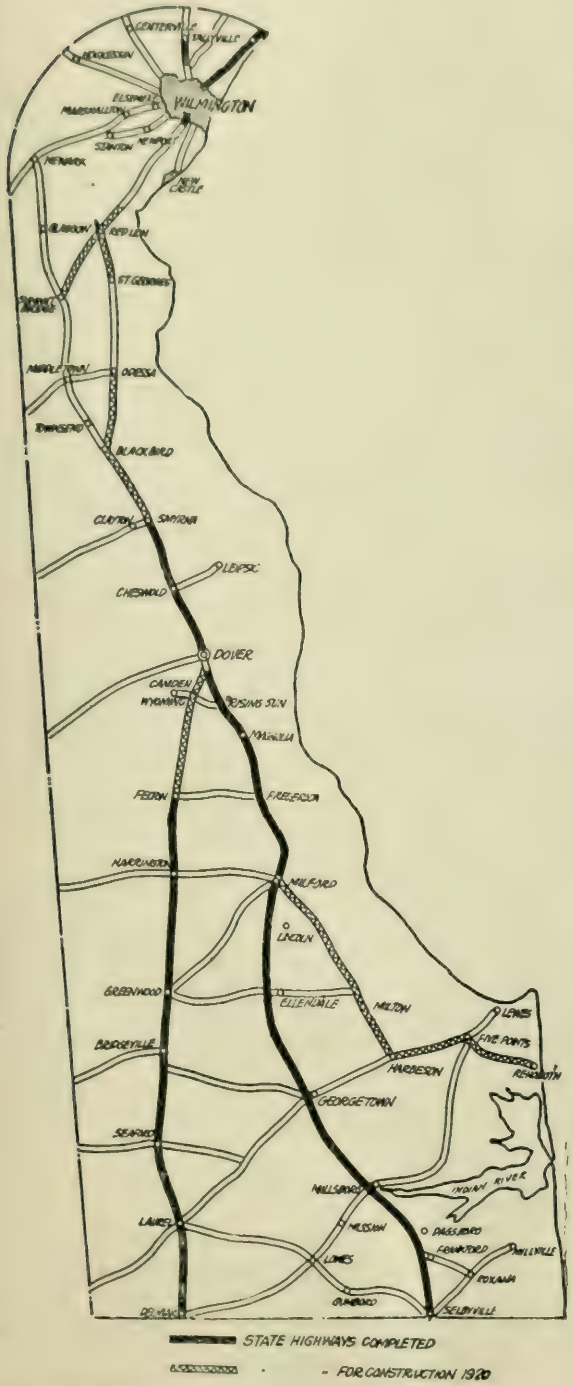
Chief engineer Upham studied the road systems of several other states, including Pennsylvania, Maryland, New York and Massachusetts, preparatory to determining the policy of the new department. It was decided that the state should maintain only those roads which it constructed, concentrating its resources upon those where maintenence would be profitable, a survey having showed that thousands of miles of roads in this state were sadly out of repair.

The state system was outlined to consist of a north and south trunk line system to supplement the country roads running east and west, with a radial system around the principal city of Wilmington. This involved approximately 270 miles.

The construction program for 1917-18 was centered upon the roads carrying the greatest traffic and suffering the worst physical conditions. In spite of war conditions, in the first 18 months over 280 miles of road were surveyed, 190 miles plotted to a small scale and detail plans made of 130 miles, while excellent progress was made in carrying out the tentative program of 40 miles of construction.

Instead of following the old country roads, as had at first been contemplated, these were found to be so winding that the effort was finally abandoned entirely and the state roads were laid out unusually straight, tangents generally being several miles long connected by long-radius curves. The flat topography permitted this and also very light grades. In order to avoid land costs, damages and condemnations and to prevent local traffic from interfering with through traffic, the roads generally avoid towns keeping about a mile or one-half mile from the town limits.

Immediately after the organization of the State Highway Department it commenced a survey of the state to locate deposits of sand, gravel and stone suitable for highway work. It found no gravel or stone except in the northern part of the state and, although there is abundance of clay, it is not acceptable for road work. The department is using the entire output of quarries at the northern end of the state but this is by no means sufficient and broken stone was imported this season at a cost of $1.50 to $1.75 per net ton at the quarries, plus 90 cents freight to Wilmington up to $1.40 freight to the southern end of the state. About 85 per cent of the sand is purchased by the contractors from dealers, 15 per cent at 60 cents per ton from a pit at Lewes and the balance from Maryland or from Delaware river dredgers.



CONSTRUCTION PROGRESS ON DELAWARE STATE ROADS

1919 LEGISLATION

In 1919 the department had a state law passed limiting to 26,000 pounds the gross weight of any vehicle and load operated on Delaware roads, and to 6,000 pounds the gross weight of trailers with metal tires, and giving the State Highway Department police power to enforce this and other acts regulating highway traffic. Traffic officers of the highway department are stationed at important points and do not only control speed but prevent the use of the roads by improper vehicles and excessive loads.

The 1919 legislature also provided that the highway department offer each year not less than $100,000 to each of the three counties, which are to appropriate as much as they receive from the state and also $100 per mile annually for the maintenance of the state-aid roads. These roads are east and west roads. Kent county last year authorized $100,000 and Sussex county $250,000. In 1920 the department set aside $750,000 for aid to the counties.

TYPE AND CONSTRUCTION

Except for one road, the Philadelphia Pike which is paved with brick, the standard adopted was concrete pavement 14 to 18 feet wide and mixed 1 cement, 2 sand, 4 stone, and 0.1 hydrated lime, as specified by the American Society for Testing Materials. It is finished with a roller 6 feet long weighing 60 pounds, and a bow-belt. Joints are provided only at the end of each day's work. Four rods dipped in asphalt and extending 2 feet into each slab are placed at each joint and no bituminous filler is used. The concrete is required to stand at least 28 days before the road is open to traffic. In one and a half years since the first of these were constructed the maintenance cost has been $3,300 for 30 miles.

In 1920 there were under contract 147 miles of roads including unfinished 1919 contracts, and 100 miles more were projected. Construction was greatly hindered by difficulty of securing cement. By June 21st, only about 40 miles of concrete highway had been placed under construction and it seemed impracticable to consider beginning any more, but no difficulty was experienced in securing asphalt and stone shipments. At a conference held on this date, it was, therefore, agreed that the program should not be held up but that the pavements should be constructed of an asphalt wearing surface on a bituminous foundation for the remaining 40 miles of the year's program. Also, a smaller experiment consisting of approximately 15 miles of asphalt surface road was tried out in Sussex county with good results.

The general policy was adopted of letting contracts in sections 4 to 6 miles long in order to encourage contractors to use efficient equipment and organization and secure low prices. Roads were built in 1918 at $36,000 a mile, in 1919 at $32,000, and in 1920 at $47,000. The labor available is mostly colored and although scarce, suffices and gives fair results for a wage, last summer, of about 40 cents an hour.

Engineering Activities of the Illinois Health Dept.

These include general supervision over water supplies and purification, sewerage and sewage treatment, stream pollution and public sanitation. It aims to assist engineers engaged in such work in that state.

A very important part of the work of the Department of Public Health of the State of Illinois is performed by the Division of Engineering and Sanitation, generally referred to as the Division of Engineering. The work of this division includes:

1. Control of installation of water supply and sewer systems, including water-purification plants and sewage-treatment plants. Examination and approval of plans for all such installations.
2. Studies of stream pollution.
3. Sanitary surveys.
4. Supervision over sanitation of common carriers, including sources and handling of water supplies.
5. Sanitary inspections of public school buildings.
6. Malaria control by mosquito eradication.
7. Studies of city waste collection and disposal and street cleaning.
8. Investigations of typhoid fever and other diseases that may be water-borne.
9. Public addresses on sanitary engineering topics.
10. Informal advice by correspondence on sanitary matters.

Because of the limited staff, it has not been possible to carry on some of these activities as thoroughly as desirable, but special attention has been given to water supply and sewerage work. Examinations have been made of nearly all existing public water supply and sewer systems, preliminary investigations and studies have been made in many communities where they should be installed, and detailed descriptive reports have been prepared of all these investigations.

It is the aim of the division to be of the greatest possible assistance to engineers of the state who may be engaged in water supply, sewerage or other sanitary work, and it is endeavoring to call the attention of all such engineers to the aid which it can give them. All the reports and information gathered by the division are available, and additional investigations can be made by the division to aid engineers who have been employed by communities to make studies or prepare plans and specifications for public improvements. There has been some criticism that the division takes the place of consulting engineers, but it maintains that, on the other hand, it always encourages the employment of competent consulting engineers by communities, and then endeavors to assist the engineer as far as its authority and duties will permit. Experience has shown that this service has been very beneficial to both engineers and communities.

The control given the division over installing or improving water supply and sewer systems has, it believes, been beneficial to the engineers because communities as a rule are more favorable to carrying out such public improvements if they are assured that such improvements have been carefully studied and plans approved by a state department. Moreover, when the plans have been approved by the division, it can often be helpful in influencing the community to take definite action when it shows a tendency to postpone any such action indefinitely.

The division recommends to communities that they employ competent engineers whenever water supply or sewerage work is contemplated, but does not suggest the names of engineers, even when requested to do so by municipal officials. On the other hand, the division will furnish to engineers, on request, information relative to any particular municipality where water supply or sewerage or other sanitary work is needed, but does not furnish a general list of places where such improvements are being considered or should be carried out. Every effort is made to have municipalities engage competent engineers when a project is first considered, that they may make studies and prepare preliminary reports with estimates of cost and make definite recommendations; rather than permit the city officials to decide, without having sufficient data before them, what they consider should be done and then engage engineers to design and carry out the work already decided upon.

This work for the engineers and the communities of the state is under the charge of Harry F. Ferguson, chief sanitary engineer, with C. St. Clair Drake, director of public health for Illinois, in general charge of the department.

City Sells Ashes

The city of Fitchburg, Mass., finds a sale for a part of its ashes, although only a small part, to factories in the neighboring town of Leominster, where the dust sifted from the ashes is used in the comb industry. The city received for ashes sold for this purpose $332.25 in 1919. The total cost during the year of collecting both ashes and rubbish (the cost of the two not being kept separate) was $16,959, so that this was only about 2 per cent of the cost. It may offer suggestions, however, for similar uses to which ashes may be put in other districts and other industries.

Millions for Manitoba Highways

The Manitoba government has submitted to the minister of railways and had approved by him plans for highway construction involving the expenditures of about $3,500,000 on 4,000 miles of roadway.

Immigration Notes

The congestion at Ellis Island still continues and the difficulties of the immigration officials due to inadequate force and accommodations are increased by the large amount of rejections that are necessary on account of the large proportion of indigent arrivals and those that are diseased, evil minded, or otherwise undesirable. The proportion of rejections is now more than twice as great as in 1914, and in one month there were 1,757 steerage passengers absolutely destitute, with no money whatever, besides 638 that had less than $20 each. The character and number of undesirables arriving shows that viséing of the passports abroad by American consuls is done without adequate facilities and that inquiry into the physical, mental and financial state of the applicant is practically nominal. It is to be hoped that the present price of steerage transportation, which is about $110 as against $25 before the war, may operate in some degree to secure more desirable immigrants.

One of the difficulties due to the inefficiency of the Ellis Island immigration office is that since October, 1918, the issuance of certificates of arrival and papers for candidates for citizenship has been neglected so that at present there are 616,400 in arrears, which, at the present rate, may increase to 100,000 per month.

The number of aliens waiting to depart from the other side for America is apparently increasing. It is now estimated that between 3,000,000 and 4,000,000 Italians and more than 3,000,000 Poles are waiting to come across; 267,000 applications have been made in Poland alone for passports, most of them for Jews. Some Italian farmers say that they are emigrating because of danger from explosions when plowing in former battle grounds. If the present conditions continue, the only limit of immigration for a long time will be the capacity of the steamships.

In New Orleans a committee of eleven, composed of representatives of rice, cane and cotton growers and steamship and railroad officials, has been appointed to devise a practical method of exploiting Louisiana resources with the view to inducing immigrants to plan, before they sail, to come to New Orleans.

A large proportion of immigrants landed in New York are destined for Chicago and vicinity, especially the Calumet district, while many have tickets through for Denver and other Rocky Mountain points, from which there has been for months a considerable migration back to Europe. Other immigrants continue across the continent to San Francisco, Seattle and Portland.

The enormous wages paid here have been duly exploited abroad and labor naturally is eager to participate in the one dollar per hour rate for unskilled or semi-skilled service. In a group of about 150 in line at the Ellis Island ticket office, 30 were bound for Chicago, 10 for Detroit, 6 for Denver and 6 for San Francisco, the remainder were going singly to a large number of destinations from Florida to Minnesota and from Pittsburg to Sacramento. The distribution is considered much wider than it has been previously for many years.

The willingness of some countries to share their population with us is illustrated by the fact that on October 9 the former "Germanic" of the White Star Line, now owned by a Turkish company and chartered by Greeks, sailed from Constantinople for America carrying 1,000 Greek, Armenian and Jewish immigrants who left without American passports and without the consent of the French authorities in charge of the port.

Advance figures of the immigration report for last year show that 41,594 aliens gave Massachusetts, 32,502 gave California, 28,227 gave Michigan, 13,212 gave Connecticut, 5,698 gave Minnesota and 4,326 gave Florida as their place of destination. In order to secure a better distribution of immigrants, a new bureau is to be established at Ellis Island under charge of P. A. Donohue from the Department of Labor. This bureau will be provided with economic and linguistic experts who will endeavor to counteract the general tendency of immigrants to settle in large cities because they know nothing of other portions of the country. The necessity for this action is emphasized by the fact that within a few days delegations from Detroit and from Akron, Ohio, have visited Ellis Island to endeavor to divert immigration from these municipalities to farm land in northern Michigan and Ohio.

The Labor Department in New York State is cooperating in the effort to secure a better distribution of immigrants throughout the country and to avoid their concentration in large cities. A bureau for this purpose has been established in New York and in most of the large cities throughout the state and billboards are erected displaying notices in many languages that all kinds of skilled and unskilled labor are handled without fees.

In reply to pleas by the immigration service a number of large enterprises throughout the country have written to the commissioner at Ellis Island offering to employ hundred of aliens. Among these companies is the Oliver Coal Company at Daleski, Ohio, that wants several hundred miners at $8.00 per day. There are also many invitations from farming companies.

Notwithstanding an increasing number of undesirable immigrants that are shipped back to Europe because they are penniless, their average prosperity is much greater than before the war. In 1914 the average cash brought into this country by the heads of families or by immigrants traveling alone was $46 while in 1920 it has risen to $119. They are also better dressed and have better household goods than formerly. In 1913 the immigrant transportation from Denmark to New York was $42 and it is now $173. From Italy it was $39 and is now $372; from Germany $34 and now $1,437; in Austria $39 and now $2,847. These figures, of course, represent the loss through depreciation of foreign currency.

Labor Items

There is in Chicago such an abundance of labor that applicants are being constantly turned away and there is prospect for much unemployment during the winter. Railroads and industrial establishments are reducing their forces, many laborers are arriving from the West, from the Northwest, and from Ohio, and the lodging houses and workmen's hotels are crowded.

A bulletin of the New York State Industrial Commission announces that figures based on the reports of 1,570 manufacturers show that there are 100,000 less workers employed in New York State factories than were employed six months ago, making a total reduction of 7 per cent. The highest employment during the last six months was reached in March, and the decline started in April with a reduction of about 1 per cent, due chiefly to the strike of switchmen. The increase has continued since then at a rate of 1 or 2 per cent per month until the present level of unemployment is about the same as it was about one year ago.

According to the United States Bureau of Labor statistics, 9 out of 14 leading industries in the United States showed a decrease of employment in September, 1920, as compared with September, 1919, while 5 showed an increase.

The eight-hour day is universal for labor in Norway and employers complain that the quantity and quality of labor has depreciated very much in the last few years, while the pay has quadrupled or more, men who received 13.4 cents per hour before the war now receive 56 cents, while men in the building trades, most of whom are employed at piece-work, make as much as $1.07. About $25 a week is considered to be a minimum living wage there for a family of four.

Complaint is made from Germany of the increase of unemployment to a great degree, part of which is attributed to the action of the demobilization commission of Berlin which required the discharge from private employment of workers not dependent on their personal earnings for their livelihood. In opposition to this it is said that the National Government will restrain proprietors of factories from shutting down on account of the high cost of production or lack of market and wage demand. There has been a strong tendency to close plants and export the machinery and equipment to foreign countries, which the labor leaders declare is the employers' sabotage and the communists equally object because it prevents them from taking possession of plant and equipment. The proposed new regulations will require proprietors to communicate with the ministry of economics and have the authorities investigate before closing.

Prison Labor on New York Roads

The prison Survey Committee of New York State, Adolph Lewisohn, chairman, has recommended to Governor Smith that prisoners be used more extensively than at present in road building and other outdoor work. This would not, however, mean unfair competition with private contractors, as the committee favors paying offenders for their labor wages based upon these prevailing in outside work.

At present inmates receive only a cent and a half a day. It is proposed that these wages be increased, and that out of the earnings of prisoners the state take the cost of their maintenance. The remainder would either be sent to the prisoner's dependents or, if he has none, be kept in trust for him until his release.

According to the committee's report, which has just been made public, that body finds that road building "is not only advantageous to the upbuilding and general physical welfare of the prisoner, but advantageous to the state."

"It is a sad commentary on prison life," the report declares, "when one reads such a statement as 'work on the road and on the farm should be given men before being paroled, in order that they may become hardened and get into fine physical trim.' It is as necessary to keep them in good physical trim while they are in prison long before they are paroled, as it is to get them physically hardened just before parole."

Reducing Force Increases Output

A Pennsylvania steel manufacturing plant was operating about two months ago with 100 per cent employees and only producing 68 per cent capacity. In consequence 10 per cent of the men were discharged and production rose to 78 per cent. Another 10 per cent of men were discharged and production rose to 85 per cent capacity. A third 10 per cent reduction of labor has brought the production up to 96 per cent of plant capacity. This is another demonstration of the well known fact that the efficiency of labor has greatly decreased within recent years, and suggests a very practical method of increasing it.

Surveying for Dallas Dam

Surveys are being made on Upper Trinity river under the direction of Major W. J. Powell by two parties, which are investigating possible dam sites for the water works of Dallas, Texas. The city commission recently authorized the expenditure of $18,000 for the completion of this survey, which will be continued for several months yet.

Preliminary work has been commenced on the $30,000,000 Bridge river hydro-electric plant at Sillovet, British Columbia.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

Protecting Concrete from Frost Part II*

Heating mixing water and aggregate, and use of anti-freezing solutions.

According to a phamplet on concrete work in cold weather issued by the Portland Cement Association, "the general opinion is that freezing will not injure concrete that has had an opportunity to harden for not less than forty-eight hours under favorable conditions; and as a rule concrete will not show any serious effects from having been frozen once, if, after being thawed out, it is not again allowed to freeze until early hardening is complete. But if, before early hardening is complete, the concrete is allowed to alternately freeze and thaw at short intervals, it will be damaged. When prevailing temperatures during the day are below 45 degrees, they often drop suddenly during the night to freezing or below. Therefore, it is necessary that such a drop be anticipated by heated materials and also that means be provided for protecting the work against freezing."

One of the largest and most successful concrete construction companies in this country issues to its superintendents and foremen a series of instructions expressly devoted to the protection of concrete placed in cold weather, in which it defines as winter work all concrete construction commenced in the fall, or before spring, or at any time that brings its completion in the cold weather; and requires the man in charge to provide in advance for either partial or complete protection of the work as may be necessary, and to make requisition for the necessary supplies required to heat and enclose the structure.

Whenever the weather is cold enough to make frost probable, heating the aggregate and the water before mixing will accelerate the setting of the concrete and improve its strength, and may often suffice, without more expensive precautions, to carry the work safely over night or through brief periods of cold or single frosts. Such provisions should therefore always be made. They may be simple and easily provided at small cost and are certain to be imperative if the cold is great enough or prolonged enough to make it also necessary to enclose the concrete and warm the atmosphere around it.

HEATING WATER

For a small amount of work, the water can be heated in kettles over open wood fires; but for work of any magnitude, some continuous system of heating it is desirable. If there is a pipe system for water under pressure, good results may be obtained by running the supply to the mixer through a section of radiator or through any gridiron or coil of pipes under which an open fire is kept burning.

Any heater like that for a kitchen or laundry, boiler, or a discarded hot water house heater, will answer the purpose if it is more conveniently available. A special heater on the market for this purpose consists of an open sheet-metal box with vertical sides, a fire grate in the bottom and an open fire pot. The fire pot itself consists of a rectangular coil fitting the box and connected to the water supply and automatically heating it as it is drawn off to the concrete mixer. The principle is essentially that of the ordinary range waterback for a kitchen boiler, and the advantage is that the open fire also serves to heat the atmosphere and thus makes the apparatus equivalent to the ordinary brasier or salamander commonly used for heating the atmosphere surrounding concrete under construction.

If steam is available, it can be conveniently used for heating the mixing water. Exhaust steam may suffice, and can be simply turned into a water barrel or tank from the open end of the exhaust pipe.

If live steam is used from the boiler supplying the mixer engine or the hoisting engine or from a special boiler, it can either be circulated through a coil immersed in the water-supply tank or be admitted through pipes closed at the farther end and perforated with small holes which are submerged in the tank and allow the live steam to rapidly heat the water. These devices can be manufactured easily on the job from second-hand pipes.

HEATING THE AGGREGATE

Sand, gravel and broken stone should always be stored in a dry place as near as possible to the mixing machine so that after being warmed, they may lose the minimum amount of heat in transit to the concrete mixer. They should be protected from storm, and if convenient may sometimes be advantageously stored in the finished cellar of the building under construction or in some unused shed that is near by it. If stored in open-air piles, they should always be protected by tarpaulin covers that not only keep off snow and rain but retain the warm atmosphere and prevent excessive radiation of heat.

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*Part I. Effect of frost on concrete, was published November 13.

Small storage piles of aggregate, and piles of aggregate that is constantly received as used may be satisfactorily heated merely by building the piles over a horizontal flue, such, for example, as an old smokestack, a few lengths of vitrified drain pipe, or some built-up brick or stone structure in which a wood or coke fire can be maintained, the flame and smoke passing from end to end of the conduit and heating all of the surface, which radiate into the pile above. The aggregate must be taken from above and pushed over the flue, or if the pile is large it must occasionally be shoveled and shifted so as to better heat the exterior portion.

When steam is available, it may be supplied to short lengths of pipes plugged at the extremity and perforated at frequent intervals with small holes. If these pipes are driven into the pile of sand, gravel or broken stone and live steam turned on it will quickly heat the material. The piles may be placed horizontally in the bottom of the storage pile and left there to keep the mass warm while the aggregate is used from the bottom of the pile and colder aggregate slides down to take its place. In this case the pipes should be perforated on one side and that side turned downward to prevent the holes from becoming clogged with dirt and sand.

For jobs requiring a large amount of aggregate or for work long continued in cold weather, the aggregate may be stored in bins provided with perforated steam pipes permanently installed on the bottom and sides of the bin. In one winter job of concreting an 18 h.p. boiler was installed especially to provide steam for heating the aggregate and the concrete forms, and delivered steam to a horizontal grid-iron consisting of six 36-foot lengths of 1½-inch pipe perforated with 3-16-inch holes 12 inches apart. This pipe was connected up in a rectangular framework on or near the level of the ground and the stone was piled over one end of it and sand over the other end. During the day, when the aggregate was constantly being taken from the piles to the adjacent mixer, the storage piles were kept uncovered, but at night they were covered with canvas and the steam pressure maintained, preventing the materials from getting cold. A 1½-inch branch from the steam main was led to a water barrel from which the supply for the mixer was taken.

There are on the market torches, provided with a blast by which a long flame can be directed to a considerable distance, that are used for heating the materials in the mixer drum while the concrete is being mixed. For this purpose the torch is arranged so that its flame enters the drum near the axis and plays directly on the aggregate while the drum revolves. In this case the inlet and outlet openings on both sides of the drum are usually covered by canvas or some other easily movable protection that helps confine the hot air in the drum. Similar results can also be obtained by letting live steam into the drum while the mixing is in process, but in this case it is well to allow for the moisture condensed from the steam in proportioning the amount of water to be used for mixing the concrete.

It is considered good practice to heat materials so that the concrete will have a temperature of at least 70 degrees when placed in the form. Generally the sand, stone and gravel are not heated to more than 150 degrees, but the water can be heated to any convenient temperature. It is not usually economical to have the material hot enough to give the concrete a temperature of about 90 degrees when discharged from the mixer.

ANTI-FREEZING SOLUTION

When only very light frosts are anticipated, it is sometimes more convenient to prevent freezing by dosing the water rather than by heating it, especially as this method will prevent freezing for a longer time than simply heating the materials before mixing. Common salt dissolved in the mixing water will lower the freezing temperature about 1 degree Fahrenheit for every 1 per cent by weight of salt added. Care should be taken not to use more than an extreme maximum of 10 per cent of salt, because in greater quantities it is likely to injure the quality of the concrete and, in any event, is undesirable because it retards the setting of the concrete.

Better results are obtained by using calcium chloride, which is not only more efficient in preventing freezing, but has a great additional advantage in accelerating the hardening of the concrete and thus reducing the time for which it is necessary to protect it from the cold, besides developing strength more rapidly. Calcium chloride is sold by several commercial dealers under different names such as "quickstone," or by its own name, and they also sell other preparations with various additional ingredients, all of them securing the same results. It can now be purchased in a solution of about 27 per cent at a price of about thirty-five cents per gallon. In one case its use in the construction of a 10-inch wall enabled the work to be continued safely when the temperature was near zero. Caution should, however, be observed in the use of calcium chloride where reinforcement steel is embedded in the concrete because some tests of the Government Testing Bureau have indicated that it caused an increased corrosion of the steel, an effect that was not, however, detected by some other observers.

Houston, Texas, Cannot Pave

Although property owners in Houston, Texas, are willing to pay the entire cost of paving in front of their properties, leaving for the city only the cost of the intersections, the city cannot take advantage of the offer since it has no money in the treasury to pay for such intersections. It is reported that the city could lay 50 miles of new pavement, all to be paid for by property owners, if it could pay for the intersections.

Recent Legal Decisions

TAXES CAN BE LEVIED BEFORE IMPROVEMENT IS COMPLETED IN KANSAS

The Kansas Supreme Court holds, State v. Stewart, 191 Pac. 269, that under the provisions of the state road law, it is not necessary that an improvement shall be completed before general county and township taxes can be levied to provide a fund to meet at maturity the first installment of the bonded debt created therefor, notwithstanding that local assessments upon the land specially benefited cannot be made until such completion.

BUILDING PERMIT ORDINANCE HELD VALID

The Maryland Court of Appeals holds, Farmers' & Planters' Co. v. Mayor, etc., of Salisbury, 111 Atl. 112, that an ordinance prohibiting the erection or repairing of buildings within city limits without the issuance of a building permit from the mayor and council, and specifying the matters to be considered on application for such permit, is valid, being a reasonable exercise of the police power granted to the city by its charter. Such an ordinance cannot confer an unlimited discretion, but this the ordinance did not propose to do. The city's action in refusing to grant a permit for the construction of an addition to a building to be used for the purpose of storing, mixing and bagging fertilizer, taken after careful consideration of letters and petitions of those living in the vicinity of the proposed addition, both for and against the grant, was held not arbitrary.

VALIDITY OF ROAD IMPROVEMENT STATUTE

The Arkansas Supreme Court holds, Nettles v. Hazlewood Road Improvement Dist. No. 2, 223 S. W. 397, that the fact that the drainage district embracing a part of the road district was declared invalid did not prevent the road improvement district commissioners from proceeding with the improvement as authorized by the special statute, as it was not shown that the carrying out of the drainage improvement was essential to the construction of the road improvement.

MUNICIPALITY'S POWER TO USE MACHINERY PURCHASED FOR WATER SYSTEM INCIDENTIALLY FOR ELECTRIC LIGHT SYSTEM

In a suit to restrain a town from carrying out a contract for the purchase of electrical machinery and equipment it was alleged that although the expressed purpose of the town's purchase was for pumping and supplying water to the town, this was only a subterfuge and that the machinery contracted for was purchased for the purpose of installing an electric light plant; that bonds had been voted and sold to construct a waterworks system and the town officials proposed to divert funds so raised to construct an electric lighting system. A municipality in its discretion may authorize its property to be used incidentially for a purpose other than that for which it is primarily purchased or constructed, if the use for incidental purposes does not interfere with the use for the primary purpose. The New Mexico Supreme Court, applying this principle holds, Page v. Town of Gallup, 191 Pac. 160, that if it were true, as the town alleged, that the machinery which it was proposed to install was necessary for the present and reasonably anticipated needs of the town for pumping water, the fact that the town proposed to use the machinery in connection with some other municipal use could not operate to prevent the town from installing the machinery. It was a question of fact, of course, as to whether the machinery in question was necessary for the operation of the water plant, or whether the council in good faith had determined that it was necessary. Judgment for the plaintiff was therefore reversed.

DAMAGES FOR FAILURE TO TILE SEWER ACROSS PRIVATE LAND UNDER CONTRACT

Part of an agreement concerning damages for the construction by a city of a sewer across private land provided that if the sewer should create an open stream to such an extent as to interfere with the use of the land for farming purposes the owner could require the city to tile the water across the land. The South Dakota Supreme Court holds, Hatch v. City of Mt. Vernon, 178 N. W. 931, that this provision came under the arbitration clause in the contract, requiring a demand for arbitration of damages in excess of a certain sum to me made by the landowner within five years of the date of the contract. The landowner could not therefore recover damages from the city for its failure to tile the ditch after the expiration of that time, where no demand for arbitration was made as required.

STATE HIGHWAY COMMISSION NOT A MUNICIPALITY WITHIN MUNICIPAL MECHANIC'S LIEN ACT

The New Jersey Court of Chancery holds, Curtis & Hill Gravel & Sand Co. v. State Highway Commission, 111 Atl. 16, that the provisions of the Municipal Mechanic's Lien Act of 1918 do not apply to labor or materials for the performance of contracts made by the State Highway Commission. The commission is not a "municipality" within the act, but is an alter ego of the state itself.

WHEN RELIEF FROM TAX BILLS TOO LATE AFTER COMPLETION OF WORK

A suit for the cancellation of tax bills issued by the duly constituted authorities of Kansas City against the complainant's property for the construction of certain sewers on the ground that the contract was not let to the lowest bidder, no complaint having been made until after the completion of the work, was denied, Welch v. Commerce Trust Co., (Mo.) 223 S. W. 768, where the irregularities charged were in great part matters of public record, and the slightest attention on the part of plaintiff would have disclosed to them all that the parties charged with bad faith knew and they made no objection or protest.

NEWS OF THE SOCIETIES

Nov. 30 NATIONAL CONFERENCE OF HEALTH OFFICERS Dr Henry F. Vaughan, Detroit, Mich.

Dec. 6-9 INDUSTRIAL SAFETY CONGRESS State Industrial Commission Syracuse, N. Y.

Dec. 8-10—NATIONAL RIVERS & HARBORS CONGRESS Annual convention. Washington, D. C.

Dec. 7-10—AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual meeting. New York. Secretary, 29 W. 39th St., New York City.

Dec. 9—THE BROOKLYN ENGINEERS' CLUB. Annual Meeting, election of officers.

Dec. 13-16—AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS. Annual convention. Washington, D. C.

Dec. 16-17—THE KANSAS ENGINEERING SOCIETY. Annual meeting. Topeka, Kansas.

Jan. 19 — AMERICAN SOCIETY CIVIL ENGINEERS. New York City.

Jan. 25-27. 1921—THE AMERICAN WOOD PRESERVERS ASSOCIATION. Place of meeting to be announced later.

Jan. 25-27—ASSOCIATED GENERAL CONTRACTORS OF AMERICA. Annual convention. Washington, D. C.; New Orleans.

Feb. 7—AMERICAN ROAD BUILDERS' ASSOCIATION. Annual convention. Coliseum, Chicago. E. L. Powers, 11 Waverly Place, New York City.

May 17-19 1921—NATIONAL FIREMEN'S ASSOCIATION. Twenty-third annual convention Fort Wayne, Ind.

June 7-9. 1921—NATIONAL FIRE PROTECTION ASSOCIATION. Annual meeting. San Francisco, Cal.

June, 1921 — CONFERENCE OF MAYORS AND OTHER CITY OFFICIALS. State of N. Y. 12th Annual Conference. Elmira, N. Y.

NEW YORK SECTION AMERICAN SOCIETY OF CIVIL ENGINEERS

At the regular business meeting November 17, the subject of "Urban and Suburban Passenger Transportation" was discussed. Henry M. Brinckerhoff, of Parsons, Klapp, Brinckerhoff & Douglas, consulting engineers, introducing the subject, discussion of which was invited from:

D. L. Turner, chief engineer, Transit Commission.

Frank Hedley, president and general manager, Interboro Rapid Transit Co.

W. S. Menden, general manager, Brooklyn Rapid Transit Co.

R. E. Danforth, vice-president and general manager, Public Service Railway, Newark, N. J.

P. H. Woodward, general passenger agent, Long Island Railroad. R. S. Parsons, general manager, Erie Railroad.

Delos F. Wilcox, public utilities expert.

George McAneny, formerly president of the Board of Aldermen, New York City.

O. B. Wilcox, vice-president, Bonbright & Co.

J. V. Davies, of Jacobs & Davies, consulting engineers.

L. B. Stillwell, consulting engineer.

Frank J. Sprague, past-president, American Institute of Electrical Engineers.

BROOKLYN ENGINEERS CLUB

A regular meeting was held in the club house, 117 Remsen street, on Thursday, October 11, at 8:30 p. m. Paper No. 170, entitled: "City Planning for the Borough of Queens," was presented by Charles U. Powell, chief engineer of the Topographical Bureau, Borough of Queens, N. Y., who discussed and illustrated with lantern slides, the history of the borough plan from the time of its first consideration; controlling elements which determined the borough plan; methods used in carrying out the plan; method of distribution of expense; and the various problems met.

Proximate meetings and papers are: November 18, "Industrial Brooklyn, Paper No. 2," will be presented by Mr. Walter Pfaendler, engineer for the E. W. Bliss Co. December 2, subject to be announced later. December 9, annual meeting of the club and election of officers for the new year.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

The importance of transportation is to be given prominence at the forty-first annual meeting of this society, which is to be held in New York City December 7-10.

Daniel Willard, president of the Baltimore & Ohio Railroad and chairman of the Association of Railway Executives, will present statistics on the railroad situation; Charles A. Morse, chief engineer of the Chicago, Rock Island & Pacific Railroad, will discuss the development of railroad feeders; Col. William Barclay Parsons will speak on the importance of freight handling at the terminals and the arrangement of terminals themselves; Gustav Lindenthal, who has prepared a project for the solution of the New York freight problem, will present his views on this subject.

Francis W. Davis, transportation engineer of the Pierce-Arrow Motor Car Company, will discuss the motor truck for long-distance transportation.

Major-General Frank T. Hines, chief of embarkation during the war, will speak on the importance of waterways in transportation.

TENTATIVE PROGRAM

Monday morning, December 6—Conference of Local Sections' Delegates. Meeting of Committee on Power Test Code.

Tuesday afternoon, December 7 (Simultaneous Sessions)—Fuel Section, Forest Products, Machine Shop Section.

Tuesday evening, December 7—Report of tellers of election and introduction of president-elect, presidential address, conferring of six honorary memberships, presidential reception and dance.

Wednesday morning, December 8—Business meeting. Amendments to the constitution, reports of standing committees, committee on code of ethics, industrial relations, education, feed-water heater standardization, sub-committee on bearing metals.

Wednesday afternoon, December 8 (Simultaneous Sessions) — Management section, railroad section, research —1. Meeting of committee of standardization of plain limit gages.

Wednesday evening, December 8—Oration on the life and work of the late Dr. John A. Brashear, past-president, A. S. M. E., will be delivered by Dr. Henry S. Pritchett, president of the Carnegie Foundation for the Advancement of Teaching.

Thursday morning, December 9—Keynote session on transportation. Railroads, Daniel E. Willard, president Baltimore & Ohio Railroad. Railroad Feeders, Charles A. Morse, chief engineer, Chicago, Rock Island & Pacific Railroad. Waterways, General Frank T. Hines. Motor truck transportation, Francis W. Davis, engineer, Pierce-Arrow Motor Car Company.

Meeting of committee on standardization of shafting.

Thursday afternoon, December 9—Keynote session continued.

Terminals, Col. William Barclay Parsons, consulting engineer of New York City.

The New York Terminal Problem, Gustav Lindenthal, consulting engineer of New York City.

Professional Session, Research—2. Effect of Fittings on Flow of Fluids, through Pipe Lines, D. E. Foster; Steam Formulas, R. C. H. Heck; Organization meeting of the Ordnance Section. Ladies' tea and dance.

Friday morning, December 10 (Simultaneous Sessions)—Design—2, Textile Section, Power Section.

The thirty-eight local sections of the society will each send delegates to the Sections Conference, which will be held this year on Monday instead of on Tuesday, as in previous years. The delegates to the conference select the nominating committee of the society and in other ways serve to bring the point of view of the membership throughout the country to council members and to the meeting.

AMERICAN ROAD BUILDERS' ASSOCIATION

The annual meeting was held November 15 at the Automobile Club of America, New York City. Routine business was transacted. Reports of committees and officers were received, and nearly 100 members and guests attended a dinner followed by several short addresses on pertinent topics.

The officers elected were: President, M. A. Faherty, chairman Board of Local Improvements, Chicago, Ill. Vice-president, Northeastern District, J. A. Duchastel, city engineer, Outremont, Canada. Vice-president, Southern District, Lt.-Col. H. L. Bowlby, chief, War Materials Division, Bureau of Public Works, Washington, D. C. Vice-president, Central District, Robert C. Terrell, State Engineer of Oklahoma, Oklahoma City, Okla. Vice-president, Western District, S. Benson, chairman, Oregon State Highway Commission, Portland, Ore. Secretary, E. L. Powers, editor, *Good Roads*, New York, N. Y. Treasurer, Senator James H. MacDonald, former State Highway Commissioner of Connecticut, New Haven, Conn. Directors for three years, Northeastern District, Irving W. Patterson, chief engineer, State Board of Public Roads, Providence, R. I.; William R. Smith, president, Lane Construction Corp., Meriden, Conn.; John Swan, Director of Public Works, Pittsburgh, Pa.; Southern District, J. H. Cranford, president, the Cranford Paving Co., Washington, D. C.; W. G. Sucro, County Roads Engineer, Baltimore county, Towson, Md.; Central District, W. A. McLean, Deputy Minister of Highways, Province of Ontario, Toronto, Ont., Canada; Western District, Austin B. Fletcher, State Highway Engineer of California, Sacramento, Cal.

The first speaker after the dinner was the new president, M. J. Faherty, who outlined the great road-building plans of the state of Illinois and the city of Chicago. Mr. Faherty has been very active in securing good roads for Illinois and expressed the desire to have the state project even greater highway improvements than now planned. He assured the members that he would arouse the interest and co-operation of state and city officials in the Chicago convention.

H. G. Shirley, secretary of the Federal Highway Council, spoke upon the urgent need of research in highway work. Foundations, sub-grades and surfacing materials are as yet little understood and money ought to be set aside to investigate these problems. He also pointed out that many states have not as great wealth as has the state of Illinois, hence the construction of highways by the Federal government will do much in aiding the good roads movement in these states.

D. C. Fenner, representing the National Automobile Chamber of Commerce, discussed the road problem from the standpoint of the motor vehicle owner, saying that sharp curves should be eliminated, grades should not be more than 5 per cent and all bridges should be able to support 20 tons. More attention, the speaker said, should be paid to the matter of securing adequate foundations, instead of trying to spread the money out over large mileage with inadequate foundations.

W. E. Albig, of the United States Chamber of Commerce, spoke upon the relation of transportation to the progress of a community, pointing out that good roads greatly facilitate the distribution of food products.

T. W. Dieckman, of the Lakewood Engineering Company, spoke upon the desirability of moving road materials in winter when more open top cars were available than in the summer. By getting road materials on the job in the winter and early spring, road work would not be subjected to the costly delays arising from a shortage of materials due to railroad congestion.

PERSONALS

Weightman, Hugh E., industrial engineer and architect, has changed the firm name to Weightman & Steigeley. The offices are located at 21 North La Salle street, Chicago, Ill.

Alexander, O. M., engineer on heating, ventilating, sanitation, power plant equipment and electricity, has opened a branch office in the Slavic Ban Bldg., Hazelton, Pa.

The American Engineering Co., Philadelphia, has opened an office in Cincinnati, with M. M. Masson in charge.

Birdseye, C. H., chief geographer of the U. S. Geological Survey, has made arrangements with the district engineer of the Corps of Engineers at Chattanooga for co-operative work on the survey which is to be made of the Tennessee river basin.

Copp, Walter P., has been appointed professor of engineering at Dalhousie University, Halifax.

Freyn, Brassert & Co., Chicago, have been appointed consulting engineers for the Royal Netherland Blast Furnace and Steel Works Company, The Hague, Holland.

Golsan, Page, consulting engineer, is to be connected with the firm of Ford, Bacon & Davis, New York City.

C. W. Hunt Engineering Corporation has been organized to take over the interests of the Hunt products and all engineering business previously performed by the C. W. Hunt Co., Inc., New York.

Ingemanson, T. W., is in charge of concrete road construction with the Iowa State Highway Commission.

Asbury, E. P., has been appointed engineer of Collin county, Texas.

Baldock, R. H., has been appointed division engineer of the Oregon State Highway Department, with headquarters at Pendleton.

Bennett, M. O., has resigned as division engineer of the Oregon State Highway Department.

Chester, The J. N., Engineers, announce the admittance of E. E. Bankson as a partner.

Crockett, J. B., formerly engineer of Collin county, Texas, is to enter the contracting business.

Creer, A. D., and MacKenzie, A. R., civil engineers, specializing in water supply, sewerage, irrigation and other activities, have opened an office in the Metropolitan Bldg., Vancouver, B. C., Canada.

Everham, Co. A. E., of the Engineer's Club, Kansas City, has been appointed a member of the building code committee, Chamber of Commerce, of that city.

Holmes, J. Albert, has been appointed resident engineer for Pearse & Greeley, hydraulic and sanitary engineers, Chicago.

Henderson, Charles E., has been appointed division engineer at Detroit, for the Morris Knowles Co., Inc.

Lamb, Richard, construction engineer, died in New York City October 19.

Mandigo, Clark R., and Prince, John, of the Engineers' Club, Kansas City, have been appointed on that city's Chamber of Commerce committee for city planning and building.

Meeker, E. A., has been appointed executive head of the Right of Way Bureau of the New Jersey State Highway Department.

Newcomb, Clive Seymour, formerly with the Dorr Company, has accepted a position as consulting engineer with the Mutual Chemical Company and the Phosphate Co.

Newell, F. H., connected with the civil engineering department of the University of Illinois, has been appointed director of field forces by the American Association of Engineers.

Anderson, G. E., formerly assistant eastern sales manager of the Duff Mfg. Co., Pittsburgh, has been promoted to southwestern sales manager in charge of the new branch office in the Railway Exchange Bldg., St. Louis, Mo.

Wilson, L. C., for the past two years general sales manager of the Chain Belt Company of Milwaukee, has been elected secretary of the Federal Malleable Company, West Allis, Wis., manufacturers of malleable castings, malleable chain and the rapid molding machine. He will be succeeded as sales manager at the Chain Belt Company by Clifford F. Messinger.

ENGINEER GOVERNOR FOR VERMONT

James Hartness, governor-elect of Vermont, is past-president of the American Society of Mechanical Engineers. The industrial growth of Springfield is said to be due in a large part to his untiring efforts. Mr. Hartness was one of the organizers of the Jones & Lamson Machine Company in that city over thirty years ago.

INDUSTRIAL NOTES

PORTLAND CEMENT ASSOCIATION OPENS VANCOUVER OFFICE

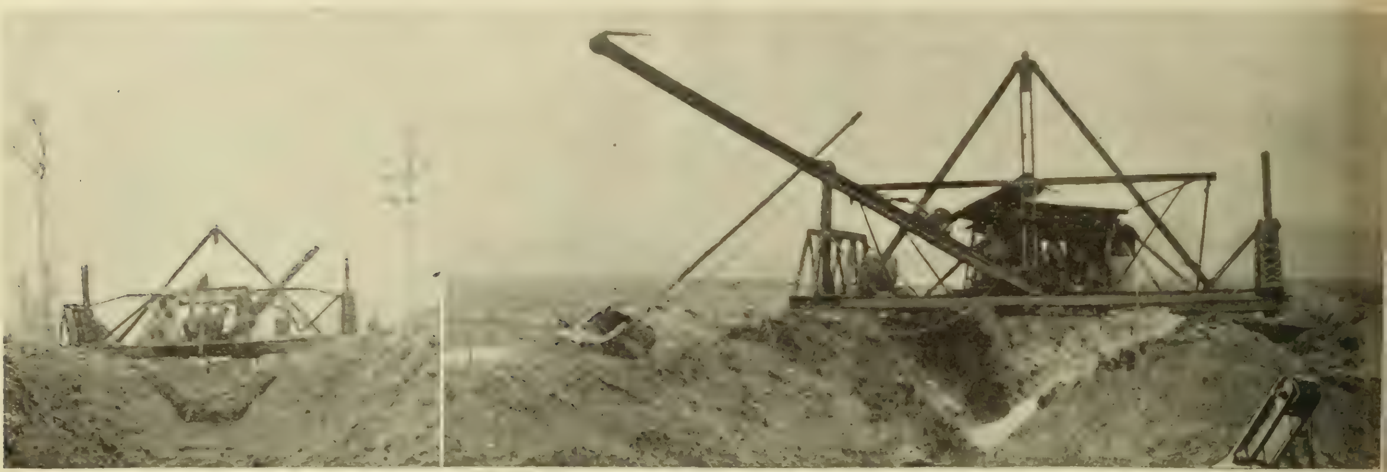
The Portland Cement Association announces the opening of a Canadian office in the Birks building, 718 Granville street, Vancouver, B. C., in charge of A. E. Foreman as district engineer. Mr. Foreman is president of the Canadian Good Roads Association and has just resigned as chief engineer of the Department of Public Works of Victoria, B. C.

GOOD MOTOR TRUCK PERFORMANCE

A round trip of 86 miles one day and 300 miles the following day is regularly made by a 3-ton four-wheel drive truck operated by the Salts Textile Manufacturing Company, Bridgeport, Conn. Alternate trips are made between Bridgeport and New York City and Bridgeport and Philadelphia. There are two drivers, one man responsible for the truck, while the other acts as assitant. On the 300-mile trip between Bridgeport and Philadelphia the men take turns driving. The truck leaves Bridgeport about five o'clock in the morning and returns about six the same evening.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations



WALKING SAND DREDGES ADVANCING WITHOUT TRACKS OR FLOATING AND EXCAVATING LARGE DITCHES IN SOFT GROUND

BAY CITY LAND DREDGES

The land dredges, built by the Bay City Dredge Works, are designed for all kinds of work, from narrow, shallow trenches to ditches with a top width of 50 feet, for cleaning out those ditches, and to provide a strong, light-weight, easily portable, economically operated machine efficient for a large variety of work. The dredges are of steel construction, light, strong, easily and quickly dismantled, moved and reassembled. All of them are equipped with an oil-burning engine and can be handled by one man, who is able to dig to the exact required cross-section.

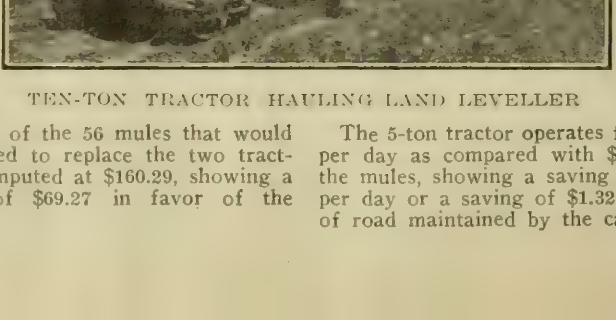
The dredges span the ditch up to a width of 55 feet, excavate to a uniform bottom and side slope, and give wide, clean berms. They can be worked either up stream or down stream, and are provided with a quick-operating self-propelling device.

The walking dredge, which moves ahead under its own power without loss of time, will walk over rocks, swamp or slippery ground and among close-cut stumps where other types of earth excavators find it difficult to work. They are built of ½-yard and 1-yard capacity with clear spans or widths of 14 feet to 38 feet and booms 26 feet to 45 feet long. The walking motion is accomplished by lifting the dredge and shifting its weight from skids that support it while digging to auxiliary skids and then pulling the dredge ahead on rollers on tracks on the auxiliary skids. It requires from 25 to 40 seconds to move the dredge up to the work. It can be moved from one ditch to another at the rate of 16 to 25 feet per minute. It can readily be steered right or left and can move forward or back.

The track type land dredges are of the same general construction as the walking dredges but are carried on steel swiveling trucks operated on track sections that are shifted by the dredge from front to rear as the machine advances. They are built of ½-yard and 1-yard capacity with booms of 14 to 66 feet. Bay City dredges can easily be converted into floating dredges mounted on a single scow or on multiple pontoons. The different types of dredges and their installations on important jobs of varying character are illustrated in Catalog C, which contains testimonials from users of this plant. It also illustrates and describes the Bay City gravel loader, of the same general design and construction as the land dredge, which is used for stripping and grading, loading sand, gravel and clay from banks or pits into wagons. They are built of ½-yard and 1-yard capacity. The former machine has loaded from 400 to 600 yards of gravel from banks to cars in 10 hours.

HOLT CATERPILLAR TRACTORS

Caterpillar tractors built by the Holt Manufacturing Company are satisfactorily used by Sumper county, Georgia, for operating a 4-ton machine, a 5-ton and a 10-ton machine. The 10-ton machine hauling the Adams leaning-wheel 10-foot grader does the work of 32 mules, and the 4-ton machine pulling one 10-foot and one 8-foot Adams leaning-wheel grader does the work of 24 mules. The 5-ton tractor, used for road maintenance work, hauls the Adams road maintainer, with a chain of drags that cover the whole road at one operation and can do 30 miles single or 60 miles double in 10 hours.



TEN-TON TRACTOR HAULING LAND LEVELLER

The daily cost of operating a 10-ton tractor, including interest on investment, depreciation, wages, supplies and repairs is fixed at $35.87. For the 4-ton tractor the cost is $33.40, while the daily cost of the 56 mules that would be required to replace the two tractors is computed at $160.29, showing a balance of $69.27 in favor of the tractors.

The 5-ton tractor operates for $25.08 per day as compared with $64.24 for the mules, showing a saving of $39.76 per day or a saving of $1.32 per mile of road maintained by the caterpillar.

PUBLIC WORKS.

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 49 FLORAL PARK, NOVEMBER 27, 1920 No. 22

Constructing a State Road in North Carolina

By W. A. Hardenbergh

Removing seven hundred cubic yards of light grading a day by steam shovel. Mixer on caterpillar traction and trucks with pneumatic tires used on red clay sub-grade. More than six hundred lineal feet of pavement laid a day. Dirt shoulders for horse-drawn traffic.

Just south of High Point, N. C., is being constructed an asphalt-topped concrete road 12,000 feet long at a cost of about $80,000. There are several features of interest in the work, among them being the speed attained in grading and in concreting. About fifty men, almost all colored, are employed, but labor-saving devices are numerous. Included in the equipment are a steam shovel, a crane, a roller, a scraper, a concrete paving mixer, and six motor trucks.

The strip of road being improved is a section of the Southern National Highway, and carries a great deal of motor traffic, both local and through, as well as considerable local horse-drawn traffic. None of the grades on the old road (which was of bituminous macadam) was severe enough to retard the progress of the average motor vehicle, but in accordance with the policy of the State Highway Department, even these are being cut down so as to eliminate nearly all the rise and fall.

An Erie steam shovel has been used for grading, except where this has been so shallow as to make its use unprofitable. The heaviest cut has been about 42 inches; the lighest on which the shovel has been used, about 8 inches. On the entire job, the shovel has cut very closely to grade, thus reducing the amount of hand grading necessary. Also very good speed has been attained at times. In a cut averaging from 36 to 42 inches, it was stated, the shovel moved 700 cubic yards in one day, wasting earth alongside the road in addition to keeping seven teams busy. An ordinary road scraper is also used in shallow grading.

The new road is of concrete base, with an asphalt top coat two inches thick. The width between curbs is 15 feet; the curbs are two inches higher than the concrete base (to make them flush with the surface of the asphalt) and twelve inches wide each. This gives the road a total width of 17 feet. To care for the not inconsiderable horse traffic, shoulders 6½ feet wide will be constructed on either side of the pavement. The concrete base is 5 inches thick throughout the entire section, the subgrade being arched to correspond to the road surface. The concrete is being mixed 1:3:6, except that the curbs, above the base, are of 1:2:3: concrete. The wearing surface is to be a stone-filled asphalt two inches in thickness.

As stated, most of the grading and excavation has been done with an Erie shovel. The earth not needed for making new fills or widening old ones is wasted along the right-of-way. This will be used later in constructing the shoulders, but that work will be done by the local authorities. On account of the added width of the new road, culverts will have to be lengthened and bridges widened. This work also will be done by the local authorities.

The soil in this section is a very dense, tight, red clay, which packs very well when damp, becomes a bottomless morass when wet, and turns into a red cloud of dust in dry weather. It does not take up any water from the concrete. When slightly dampened it compacts well under the roller, and shapes up to grade easily. In wet weather, work has to be suspended.

The fine-grading gang averages about ten men. They are followed by a Kelly roller. On some of the work the road scraper has been used just ahead of the roller to give the subgrade its final shape.

Water is taken from the High Point municipal system and is carried through a line of 2-inch pipe. Wooden forms are used, and these are held in place with wooden stakes.

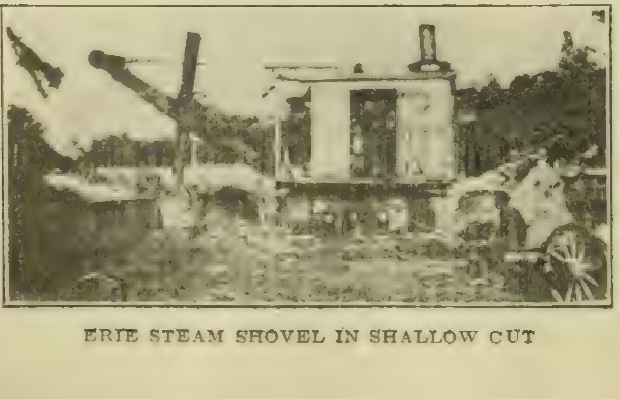
A Foote paving mixer with caterpillar traction is used. This handled very well under the difficult soil conditions of the job. Batches of sand, stone and cement, already properly proportioned, are brought by motor trucks and mule carts from the stock piles, and dumped into the mixer scoop. This does away with the trouble and waste of stock piles on or along the right-of-way, and has proved very efficient. The daily average of 17-foot pavement laid has been just above 600 feet, though this amount has been exceeded at times. Only thirteen men are ordinarily employed at the mixer—15 men occasionally. Two men help dump the trucks and carts with the batches of sand, stone, and cement ready for mixing. In addition there are: One engineer, one fireman, one foreman, two finishers, one curb-man, and five men on the spout and spreading the concrete. Behind the mixer, on the wet concrete, is towed a platform about 6 feet wide and 8 feet long, on which is mixed by hand the concrete for making the curbs.

A rather wet mix is being used. Since an asphalt wearing surface is to be added, no finish is given to the concrete. No expansion joints are being used. The new concrete is protected, as it sets, by a thin dirt covering.

Local sand is used. This was hauled from time to time to the contractor's stock-yard in the edge of the city, and there piled by means of an Erie Crane, Type B, with a ¾-yard clamshell bucket. Stone is shipped in by rail from the contractor's quarry in another part of the state, and is unloaded by the crane and piled. This same crane also charges the trucks and carts with sand and stone. A crane-man and a fireman have unloaded a car in 35 minutes. Throughout the day, an average of a car an hour has been unloaded, the crane at the same time charging the trucks and carts.

The contractor, H. G. Lassiter & Co. of Greensboro, N. C., is using six Ford trucks equipped with pneumatic tires, and from six to ten (at present seven) one-mule carts for hauling the already proportioned batches from the stock-yard to the mixer, the number used depending upon the length of haul. The carts are the ordinary one-mule cart found so commonly throughout the south. They are equipped with side and end boards, and so pivoted that when loaded, the weight is nearly balanced. Two men can easily dump them into the charging scoop, which is equipped with a stop-block to secure the proper position of the cart when dumping.

The Ford trucks are equipped with 4-inch Royal Cord (U. S.) pneumatic tires, and the body construction and arrangement is essentially the same as in the carts. The driver does nothing but drive; the two men at the mixer dump the truck; the crane at the stock-piles loads it. The work is well organized, and it is rare to see a waiting line of trucks and carts, or to have the mixer stop for lack of materials.



ERIE STEAM SHOVEL IN SHALLOW CUT

ERIE CRANE LOADING MULE CART WITH AGGREGATE

As has been mentioned, the soil, when at all wet, cuts up very easily. The pneumatic tires tend to pack down the already rolled subgrade in front of the mixer, where solid tires would cut it up. The use of pneumatics also reduces the number of cars stuck in soft places—almost eliminates this trouble.

The crane is placed between two large piles, one of stone, the other of sand. When a cart or truck drives up, the clamshell delivers stone, then sand, cement is added nearby, by hand.

Both 2-bag and 3-bag batches have been used, though at the time the writer visited the job, a two-bag batch was being used. It is hard to see just how the crane operator is able to judge very closely the amount of sand and stone per batch. For a three-bag batch, he delivers nearly a bucket of stone, and about half as much sand. For a two-bag batch, it is much more difficult, since only about 2-3 of a bucket of stone and 1-3 of a bucket of sand are required.

The asphalt top is to be mixed in an F. D. Cummer plant now being set up. A concrete tank to hold three carloads of asphaltic cement (Texaco) has been constructed, and it is expected that "hot stuff" will be turned out in the near future. This will be handled by the same trucks now used for concrete aggregate.

Highway "Lighthouses"

Local papers state that the entire state highway system of Wyoming is soon to be equipped with highway "lighthouses," dangerous curves being designated by yellow lights and railroad crossings by red lights. The lighthouses will "wink" 45 times a minute, throwing a 9-inch ray which can be seen for a distance of three miles.

Delivering Concrete Road Materials

A 7-mile concrete road with 2 miles of 8 per cent grades near Binghamton, N. Y., is being constructed by the Rossoff Engineering Company. Sand and stone are delivered in trucks over the pavement after it is 14 days old; they are dumped on the pavement and reloaded into batch boxes carried over sub-grade by an industrial railroad an average distance of 1¼ miles to the mixing machine, which is of 3-bag capacity and has made a record of 450 feet in one day.

The aggregate is hauled an average of 3½ miles by the trucks and on account of the heavy grades only 18 cubic feet are loaded into a 28-foot batch box.

The aggregate is handled by five 10-ton trucks and by 40 Western steel batch boxes and 20 Western road-builders' trucks operating over 6,500 feet of industrial track, and hauled by a Whitcomb 6-ton gasoline locomotive and a Porter 6-ton steam locomotive. Water is pumped 2 miles through a 2-inch pipe and a 75-foot lift with a 2½-h. p. engine and then lifted 800 feet more from the road to the mixer by a 6-h. p. booster pump. The mixer gang consists of 8 men and the water boy, besides a man at the finishing machine and the superintendent.

Repairing Wood Pavement With Jackscrews

Wood block pavements in St. Louis that had become loose by the shrinkage of the wood were repaired by cutting in the pavement transverse slots and in each slot laying a pair of 4 x 6-inch horizontal timbers separated by jackscrews. When the jackscrews were operated in dry, warm weather they pushed the blocks over the softened filler for a maximum distance of 125 feet, and when the pressure was maintained, closed the joints and greatly improved the pavement. No permanent compression was caused, and the blocks showed no tendency to creep back when the jackscrews were removed.

Laying Two-Course Concrete Pavement at One Operation

A 14-mile concrete road 16 feet wide near Charleston, Mo., has a 1:3:5 bottom course with a 2-inch top course of 1:2:3 concrete. The work is being executed by Roy Williams, contractor, who has installed a Koehring No. 21 paver, an Osgood shovel, a Lakewood finisher, 50 Western trucks, 100 Western batch boxes of 32 cubic feet capacity, three 4-ton Whitcomb locomotives, 4 miles of industrial tracks and 3 elevated storage bins.

A large supply of sand and gravel is maintained in storage piles on the ground opposite the bins, which are kept full by the crane that unloads the aggregates and reclaims it from the storage pile to the bins at a small extra cost for rehandling. A train of trucks, each carrying two batch boxes, is loaded by gravity from the bins, where every fourth car is marked to receive 5 bags of cement per batch box when the cars are hauled opposite the platform of the storage cement house, while the other cars receive 3 bags per batch box. At the site, three 6-bag batches are mixed and spread; then two 4-bag batches of the richer material for the top course are mixed and spread, finishing the concreting of that section without delay and insuring perfect bond between the upper and lower courses. At the mixer there are 10 men and a foreman, against a total of 27 men and foreman when the work is done with wheelbarrows. The use of a 4-bag or larger machine instead of a 3-bag machine required for the base course enables the contractor to build an 18-foot pavement as rapidly as a 16-foot pavement with the smaller machine.

The use of industrial tracks, instead of the 15 trucks that it is estimated would be required to haul the material, saves the services of 9 men. The three locomotives employed consume about 60 gallons of gasoline per day in comparison with 240 gallons that would be required for the 15 equivalent trucks.

Kansas City-New Orleans Highway Planned

A 700-mile highway, an approximately air-line route from Kansas City to New Orleans, has been planned and the project is in charge of the Burham Engineering Company, Glenwood, Ark.

This road is intended to shorten the distance of travel between the entire upper Missouri valley region, and the principal gulf port and to intersect in its course five interstate and transcontinental highways, namely: The Santa Fe Trail at Kansas City; the Ozark Trail at Joplin; the Albert Pike Highway at Ft. Smith; the Scenic route of the Bankhead Highway at Glenwood, from which point Hot Springs, eastward, and Texarkana, the outlet to Texas and points west, are served.

According to state highway experts and Federal students of interstate travel, the Kansas City-New Orleans highway is one of the most strategic pieces of road work projected since the good roads movement began in Arkansas.

The route through Arkansas will open up one of the richest mineral regions in the state, and develop vast areas of rich lands now idle by reason of lack of transportation facilities.

It is stated that 600 miles of the total length of the highway has already been built and will be available when connected up to the intermediate portions and modified if necessary to conform to the standard requirements. As proposed, the highway passes through Joplin, Portsmouth, Glenwood, Monroe, Alexandria and Baton Rouge.

Value of Good Roads For Automobiles

It is estimated that in Iowa there are now about 430,000 automobiles and automobile trucks that have an average mileage of 5,000 for their tires and the present mileage could be increased to 12,000 if the roads were well paved so that with tires at $20 each, there would be a saving of more than $17,000,000 per year on tires alone. One-third of the present amount of gasoline would be saved on good roads and assuming this to be only one-third of a gallon a day for each automobile, it would amount to $10,000,000 per year. The saving on repairs and upkeep of cars would reach nearly $7,000,000 more, which, with the additional sum derived from the auto tax, is sufficient to build three roads across the full width of the state at a cost of $40,000 per mile.

Virginia Road Construction

In order to expedite the completion of the entire 6,800 miles of road in the state system of Virginia, George Coleman, state highway commissioner, and Dr. S. M. Dollman, general director of the State Highway Association, have been making a campaign through southwest Virginia in the interest of the Constitutional State Amendment that will grant to the general assembly and governor authority to issue bonds and enable them to thus raise $40,000,000 to complete the road construction program, which, on the pay-as-you-go plan, will require eighteen years. By the bond method, the result will be accomplished in six years and without additional taxes, by increasing the tax on motor vehicles twenty cents per h. p.; thus enabling the bonds to be retired in nineteen years.

It is considered essential to complete as early as possible the Virginia section of the state highway from Washington to Winchester and down the valley of Virginia to Roanoke and Bristol, thus forming a backbone road for 41 of the 99 counties of the state. This line is a part of the direct New York to New Orleans route and contains in its zone about one-half of the area of the state. The route is already completed from New York to Washington and passes through a section that is very attractive to tourists.

Record Highway Construction

The Pennsylvania Highway Department announces that during the week ending Thursday, October 14, all Pennsylvania records on road construction were broken by the construction, on various projects in that state, of 26.27 miles of highway.

During the present construction season and up until October 19, the State Highway Department of Pennsylvania has constructed approximately 320 miles of modern type roadway, and its maintenance forces have entirely resurfaced approximately 315 miles of macadam roadway and have oiled approximately 1,300 miles of road.

Highway Detours

Citizens of Rhode Island in the vicinity of Newport have registered complaint with the State Board of Public Roads against the manner in which a section of road in Tiverton is being reconstructed, the complaint being that the entire length and width of the road was torn up at once and no serviceable detour furnished except one through private land for which the owner charges a toll of 10 cents for each vehicle. As similar complaints are being raised in a great many states where road construction is under way, the reply of the board is interesting.

In general, it stated that the road carries less than 10 per cent as much travel as some other sections of the state road and yet the cost must be nearly as high, and that consequently it does not feel warranted in spending any more money on the construction than is absolutely necessary. The contractor took the work for more than $5,000 under the engineer's estimate and the board did not think it fair to insist that the cost of the work to the contractor be increased by insisting that he do the work in short sections. The board maintains that, while conditions for traveling along this road are uncomfortable, they are not impossible or dangerous and not a single report of an accident at these points has reached it.

As to the matter of the private detour for which a toll is charged, it stated that this was arranged at the express wish of representative citizens of the neighboring town, who informed the board that they would gladly pay a toll for the use of the private road and asking the board to fill in the gutters at each end of the detour onto the private land so that it could be used. The detour which is available for passing around the road under construction is in poor condition, but it is not a state highway but is under the supervision of the town of Tiverton.

In this connection, as in others, complaining citizens generally neglect to reflect that avoidance of the conditions against which they complain would frequently involve additional expense, which must come out of the taxes or in some other way from the pockets of the public generally. As the board in this case points out, to have provided in the contract that the road be built in short sections would have undoubtedly increased the cost of the work; a detour was available and if this was not in good condition the blame did not lie with the board; and the comparatively light travel on the road did not seem to warrant the charging of the state with as great expenditures during construction as might be advisable in the case of more heavily traveled thoroughfares.

In any case, to furnish a detour which would be thoroughly satisfactory to the travel on a given road which is under reconstruction would mean that, when the road itself has been reconstructed or repaired, there will then exist two routes suitable for the travel which could presumably be carried by one, which would not be ultimate economy.

Highway Bridges in New Jersey

One of the members of the New Jersey State Highway Board, David Young, has recently resigned, giving as one of his reasons that he does not wish to be held responsible for the collapse of any of the bridges of the state, for the reinforcement of which there is apparently no present provision. In his letter of resignation he states that the bridge engineer estimates that it will require $18,000,000 to reconstruct and repair the highway bridges of the state so as to make them safe. He estimates that it will require $76,000,000 to complete a highway and bridge program which will satisfy the citizens of the state and that no such amount is available, the other $58,000,000 being for the construction of state highways not yet under contract.

On the other hand, he does not believe that any general manager of a private corporation would advise new construction of such magnitude at present prices, but that such a manager would recommend completing contracts now under construction or signed and for which money has been appropriated, but would stop at once the building of any other new roads, would arrange at once for the reconstruction of unsafe bridges, and organize a maintenance department that would adequately maintain the roads in a safe and comfortable condition until prices became normal. He believes that by holding off for normal times and prices to return, the road construction work could be done for about one third of present costs.

Old Stone Sewer Collapses

By Edward S. Rankin*

Timber bottom of sewer fifty-seven years old rotted away and part of side wall collapsed. Method of repairing described.

The accompanying photographs show the results of a break which occurred recently in one of the old Newark, N. J., sewers, known as the Mill Brook sewer. In the early days Mill brook was an open stream, fed by springs and ran through a narrow valley into the Passaic river. In 1863 part of the brook was enclosed in a stone arch of about 10-foot span and varying from 6 to 12 feet in height. The natural bed of the brook formed the bottom of the sewer, as it had now become. About 25 years later a timber floor was laid and this has lasted, with a few repairs, ever since. After arching over the brook, the valley was filled to the surrounding level, a depth of about 18 feet, and in some places buildings have been erected directly over the sewer.

Early in November, 1920, a small hole about 2 feet in diameter was discovered in the surface of the ground, at the side line of a street crossing the sewer at right angles. Investigation showed that the earth below had caved in and just below the surface the hole was some 12 feet in diameter, partly beneath a one-story brick building. Figure 1 shows the hole after breaking down the surface and shoring up the building.

It was found on investigation that part of the timber flooring of the sewer had washed out and some of the stone near the bottom had been carried down the sewer, leaving an opening through which the earth above had been gradually undermined and carried away. The break occurred close to the point where the old stone arch joins a 9-foot circular brick sewer built in 1873.

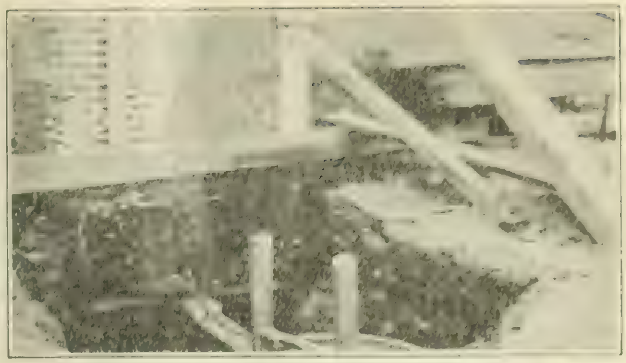


FIG. 1—BUILDING SHORED UP OVER CAVED-IN SEWER

Figure 2 shows the junction of the stone and brick sewers, with a flume in place to carry the water while repairs were being made. The hole in the stone-work is not visible, being below the surface of the water on the right and just beyond the end of the flume.

In making the repairs, two sand-bag dams, braced with timbers, were built, one above and one below the break, and the flow was carried across through the timber flume shown in the photograph. The water between these dams was then removed with a hand pump.

Where the timber floor was washed out, a new bottom was formed of concrete placed in bags closely packed together. The break in the side wall was repaired with brick masonry.

An inspection has been made of this entire section and other breaks discovered farther up the sewer. These will be repaired in the same way. The arch is in good condition throughout.

The difficult part of the work is building the dams owing to the large volume of flow and the steep grade of the sewer. The sewer takes the combined flow from 1,740 acres, including the overflow from a large park lake. Should a storm occur while the dams are in place they would doubtless be carried away.

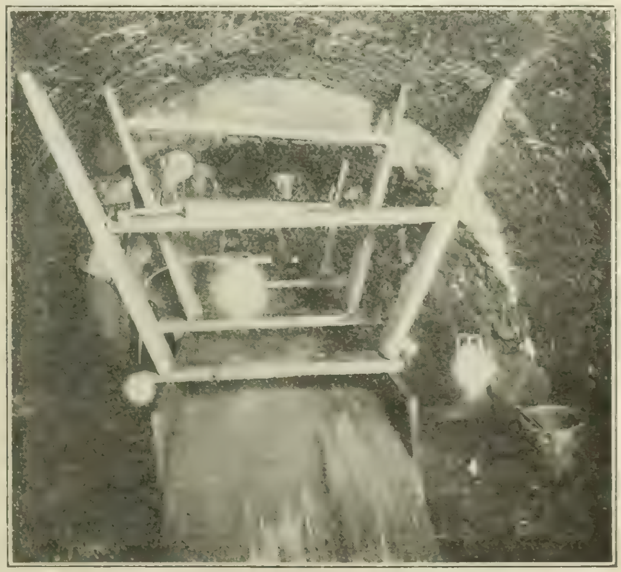


FIG. 2—VIEW OF INTERIOR OF SEWER AT JUNCTION OF STONE AND BRICK ARCH

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*Engineer in charge, Bureau of Sewers, Newark, N. J.

The Disposal of Trade Wastes

By Robert Spurr Weston*

In a paper before the American Society for Municipal Improvements, the author summarizes quite fully the present status of this subject from the viewpoint of the municipal official, illustrating special features by examples of recent practice.

It is not the purpose of the writer of this short paper to cover the whole field of the disposal of trade wastes, voluminous treatises on which have been written by such writers as Schiele, Wilson, Naylor and others. There are certain features of the subject, however, which are of particular interest to municipalities. These are the treatment of wastes which must be received into city sewers and disposed of by dilution or in disposal works after mixture with domestic sewage, all of which are apt to produce nuisances when disposed of within municipal limits.

CHARACTERISTICS OF TRADE WASTES

Trade wastes differ greatly from sewages in their character and composition. Thus the sewage from the Center avenue sewer at Chicago, receiving the stockyard and Packingtown wastes, contains ten times as much total nitrogen, four times as much suspended solids, six times as much oxygen consumed, and nine times as much fats as the rather weak combined sewage from the Thirty-ninth street sewers. Again, the sewages from Massachusetts and English industrial cities are totally different from those from residential cities in the same regions. The trade wastes are usually much more concentrated, yet ordinarily of smaller volume than sewages. Consequently their importance increases with the dominance of the industry producing them in each particular locality.

Trade wastes are important factors in the design and operation of sewage works because they may contain:

1. Excessive amounts of suspended matter.
2. Suspended matter which may clog sewers.
3. Excessive amounts of fats and other organic matter.
4. Waste mineral oil.
5. Free acid.
6. Chemicals which inhibit the purifying action of bacterial beds.
7. Starchy or saccharine bodies which ferment with the production of butyric acid and other offensive compounds, and furthermore produce lactic and other acids which inhibit the action of the nitrifying bacteria.

It seems best in this paper to cite examples of the various classes of waste, although it must be borne in mind that the members of each class may differ almost as much in degree, if not in kind, as the classes among themselves.

(1) EXCESSIVE SUSPENDED MATTER.

In Peabody, Mass., not many years ago, waste from rapidly growing tanneries, glue factories and similar industries were discharged into the North river and its tidal estuary between the cities of Salem and Beverly. At that time the stream conditions became unbearable. Sometimes the odor from the foul, dark-colored stream could be detected in Salem's best residential section, several blocks away; while at all times abundant bubbles of the gases of decomposition were generated in the putrefying deposits of sludge and rose to the surface of the stream. Conditions were by no means improved when a half-tide dam was constructed by the electric light company to insure a water supply for its condenser at all stages of the tide.

The condition in the stream was remedied by the construction by the cities of Peabody and Salem jointly of an intercepting sewer discharging into a pump well, from which the sewage was pumped through an outfall into deep tidal water. The various plants which had formerly discharged into the river were connected with the intercepting sewer. For a time all went well; but soon deposits accumulated in the sewer, particularly because pumping was often interrupted, and the velocity in the sewer was reduced to almost nothing. These accumulations of sediment are illustrative of the second class of difficulties, namely:

(2) THE SUSPENDED MATTER IN TRADE WASTES

This consists largely of spent lime, hair, strips of hide, particles of flesh, etc., which, when once allowed to settle in the sewer, compacts into a pasty mess which can only be removed by scouring or mechanical cleaning.

To remedy this condition, the industries were required to submit their waste to subsidence before discharge into the sewer. The quantities of suspended matter in the wastes, however, were so large and the basins so often too small or neglected, that the difficulties, even at this writing, have not been entirely overcome. A patented device, known as the Dorr clarifier, has helped to overcome the difficulty in two of the worst cases. This clarifier is a circular subsiding basin in which the waste enters at the center and is discharged at the circumference. The sludge which subsides to the bottom is moved constantly toward the center by means of plows attached to revolving radial arms. The sludge so moved to the center is pumped to a loading bin, which, in turn, discharges the thick pasty sludge into carts to be hauled away. The advantage of this device over hand-cleaned subsiding basins is greatest where large amounts of sludge are handled. It discharges sludge continuously, thus maintaining the efficiency of the basin for subsidence, and almost compels the proper removal and disposal of the sludge.

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In addition to the subsiding basins, screens have been installed to remove the hair and hide from the waste before subsidence. These minimize the compacting of the sludge both in the subsiding basin and in the sewer, and greatly facilitate the removal of the sludge from either hand-cleaned or mechanically cleaned basins.

(3) EXCESSIVE AMOUNTS OF FAT AND ORGANIC MATTER

Wool-scouring waste, which is the soapy, alkaline liquor in which wool is washed prior to combing and spinning, is a good example of this class. The composition of wool waste depends very largely upon the character of the wool scoured. Wool from our own territories and from South Africa is often very dirty, while some domestic and most Australian wool is quite clean. The dirt consists chiefly of sheep manure and particles of soil over which sheep have grazed. It also contains other foreign matter, such as fibre, burs, etc. This waste is usually very concentrated. It may contain 3 per cent of solids, of which one-third may be fats. The fats are of two kinds—first, wool grease or lanolin, a waxy substance which is present in the raw wool, and second, the fats combined with the soaps used for scouring.

The experience at Hudson, Mass., has illustrated the difficulties which this waste causes. Prior to 1909, the waste from a wool-scouring plant was discharged into the Assabet river. Complaints resulted in the discharge of the waste into the town sewerage system, and its attempted disposal by septic tanks and intermittent sand beds. In a few months the sand beds were completely clogged and had to be renewed, and the scouring waste was again discharged into the river. Then complaints by parties below resulted in the construction by the company of an acid wool grease recovery plant. In this, the waste was treated in tanks with sulphuric acid or nitre-cake—the whole being stirred with air. After the subsidence of the sludge, the partially clarified acid liquor was discharged through sand filters into the river. The effluent from this plant usually had an acidity of 2,000 p. p. m., and contained less than 50 parts of fats. The sludge was discharged on sand beds, dried, made into burlap-wrapped "puddings" from which the grease was hot-pressed in steam-jacketed hydraulic presses.

However, the treatment of the waste with acid produced a local nuisance, due to the acrid odors given off from the acidified waste, and suits were brought by neighboring owners to recover damages. The company therefore determined to change its method of operation. Acid treatment was abandoned, and the heated and settled waste was passed through centrifugal machines, and the effluent, after filtration through the sand, was discharged into the stream. This process removes about 50 per cent of the fats as compared with about 95 per cent removed by the acid process, and it is questionable whether the discharge of the soapy effluent is desirable. The effluent possesses an advantage over the effluent from the acid process in that it is not acid, and while it contains more fats, they are either combined in the form of soap or are so thoroughly emulsified that they are cared for by the streams without offense. The appearance of the stream at the point of discharge is not so good as when the acid waste was discharged.

During the war, the removal of fat was a very profitable process. With present prices, however, the cost of recovery per pound of grease is slightly greater than the selling price.

(4) PRESENCE OF MINERAL OIL

Increased use of fuel oil is placing an increased burden on sewage works. The large factories store large volumes of oil in tanks. In these, paraffine-like bodies settle out, which, when discharged into the sewers at times of cleaning, coat their insides, and when conveyed to sewage disposal works cause a great deal of clogging. So far, examples of this effect are neither numerous nor as yet serious, but municipal officers are fearing more trouble on this account.

(5) FREE ACID

Certain sewerage systems receive the drainage from mines; others receive the so-called "pickling liquor" from plants where steel plates or wire are scaled by immersion in sulphuric acid. This factor is most important in cities like those in the Pittsburgh region where there are large steel wire and plate mills. At Worcester, Mass., acid waste is discharged at certain times of the day, and is stored in tanks so that it may be distributed uniformly throughout the twenty-four hours and thus be neutralized by the rest of the sewage.

Recently a patented process has been used to treat acid wastes of this kind. Lime or powdered limestone is added to the waste, and the precipitate is recovered in a continuous subsiding basin of the Dorr type. The sludge so produced is recovered and used for the purification of illuminating gas.

(6) PRESENCE OF BACTERIAL POISONS

The wastes from many tanneries where arsenic is used, and sewages containing free chlorine and copper salts may not be purified by bacterial action. The sewage of the East street sewer at New Haven is an example of this, as are also the sewages of many other Connecticut cities largely engaged in the manufacture of brass and copper articles. At New Haven, Professor C. E. A. Winslow, in a long series of experiments, determined that this sewage could not be purified by the activated sludge process because of the poisonous action of the copper salts contained in the sewage, and recommended that the waste be acidified with sulphurous acid and the sludge produced by this treatment be dried and degreased to recover fats and fertilizer, following the methods recommended by Hatton for the utilization of sludge at Milwaukee. The process is known as the Miles process and has been described before this society.

(7) THE PRESENCE OF ACIDS RESULTING FROM THE FORMATION OF CARBOHYDRATES

In the manufacture of lactic acid from starch, and in the manufacture of sugar, whether from beets or from cane, there is produced a waste which ferments quickly and rapidly with the production of lactic acid, also small quantities of butyric and other foul-smelling compounds. Similar decompositions take place in the waste whey (containing sugar discharged from cheese factories) when an attempt is made to dispose of wastes containing it by subsidence. They ferment rapidly until enough lactic acid has been produced to stop fermentation. The addition of lime causes fermentation to begin anew, but the calcium lactate formed by the addition of lime also decomposes with the production of butyric acid and other disagreeable compounds. Further decomposition in the presence of sulphates causes the evolution of hydrogen sulphide.

An attempt by the writer to dispose of this waste by treatment in tanks and on trickling filters has not proved successful. Pearce and Greeley, in experiments with the waste from beet sugar factories, have shown that successive treatments with lime, each treatment followed by filtration, will produce effluents suitable for discharge into most streams. How to purify it for discharge into the beds in the dry season, a crying need in Cuba, is a question that has not yet been answered. The best solution which has been offered is to remove the saccharine bodies by an alcoholic fermentation, using yeast, and to dispose of the waste so treated by subsequent subsidence and filtration, with or without the addition of lime as may be necessary.

It is as a local nuisance that the problem is of interest to municipal officers. At Mansfield, Mass., a lactic acid factory was established near the residential section of the town. The solid portions of the waste were discharged upon filter beds, the effluent from which was in a putrefying condition. The liquid portions were discharged into a swamp in which they created an intolerable nuisance, killing vegetation and producing deposits of black sludge smelling strongly of hydrogen sulphide and rancid butter. No solution of this problem was ever worked out, for the company gave up business while a suit by the town against them was pending.

The citation of the above cases is enough, the writer believes, to give an idea that trade wastes show far greater variation in character and kind than do ordinary sewages, and each waste is a problem by itself. Municipal officers, therefore, in designing sewerage systems, should carefully consider the industries which the system is to serve, and where new industries are projected, the character of the business should be carefully determined with respect to its effect upon the sewerage and particularly the sewage disposal system, if such there be.

Since the days of Herbert Spencer, scientists and economists have deplored the loss of values by the discharge of the wastes of human life and industry. While the word conservation has a taking sound, and there is great opportunity for its employment in the industries, opportunities for disposing of water-borne wastes at a profit are few. During the war, wool grease could be recovered at a profit; and some recent studies here and abroad promise the profitable recovery of grease and fertilizer base from certain wastes and sewages. But on the whole, the recovery of valuable products from water-borne waste cannot hope to be a profitable business. On the other hand, it can, in many cases, minimize the cost of disposal and at the same time conserve valuable by-products.

In the eastern part of the United States, the necessity for studying the trade waste problem is increasingly pressing. This study was neglected during the war, although the war industries polluted many streams as they were never polluted before. The conditions of rivers like the Blackstone, the Passaic and other smaller rivers are largely due to the discharge of trade wastes, and in many places the removal of these wastes is demanded. In some cases they must be discharged into the municipal sewerage systems; in others, separate disposal by the industries must be insisted upon. In any case, each problem is like no other, and must be studied in the light of its own surroundings.

Garbage Collection in Sacramento

The Capital City Scavenger Association, which had been collecting garbage in Sacramento, Cal., under contract, recently lost its equipment and barns by fire and if it is to continue in business it must purchase a large amount of new equipment for that purpose. Immediately following the burning of the equipment, the city commissioners arranged with the State Highway Commission for the use of automobile trucks owned by that commission for collecting garbage and carrying it to the city incinerator or the dump. Following the fire, the scavenger association stated its unwillingness to renew garbage collection unless it was given a contract for 10 years to justify it in an investment in a new equipment. The commissioners at last account were undecided as to whether to endeavor to arrange with this or another private company or to undertake municipal collection and disposal.

The president of the city commission, C. A. Bliss, believes this to be an opportune time to consider municipal collection and disposal of the garbage, and the matter is now being discussed and seriously entertained. Commissioner Bliss is reported as stating that the various civic bodies of the city are all in favor of this move. The city is spending about $10,000 a year for destroying garbage and the possibility is suggested of reducing the expense or turning it to an income by garbage reduction or hog-feeding.

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Conservation of Water Supply

Wasted water costs money, even when the water flows by gravity and is not purified or otherwise treated.

One of the larger cities of New York States is to have this fact brought home to it by an increase of one-third in the water rates charged by its municipal plant, which increase is made necessary by the large sum spent in building the additional conduit and reservoir required to increase the capacity of the system for supplying the city with water. We do not mean to imply that in this particular case the citizens are unusually wasteful; but it is extremely probable that if they would all exert ordinary care in preventing any waste or loss of water, the expense which necessitated this increased rate could have been avoided or at least postponed for a number of years. Other cities, some in sections where water is scarce and others in sections where the population is dense, are rapidly approaching, if they have not already reached, the point where actual inability to increase the supply will compel economy in its use.

What amount of water is really necessary for legitimate use is discussed in this issue by Mr. Saville, and he produces some recent figures gathered in well-metered communities to indicate what may be considered a legitimate rate for domestic and other uses. His figures confirm what has been said heretofore, that the majority of cities are using at least double the amount of water necessary for all reasonable needs. Mr. Saville also, however, gives prominence to the opinion of a number of leading engineers that even legitimate uses are increasing slowly but continuously, and that what may be considered a reasonable amount of per capita consumption at the present time may not be sufficient for all legitimate needs of fifty years hence.

Whether the impelling agent be a limited supply of water or the cost of increasing the present supply, there can be no question that the cities of the country are being forced to a realization of how wasteful they have been in the past and to make some effort toward cutting down their extravagant waste of both water and municipal expenditures.

Draining Wet Sand

Whenever a stratum of fine sand is permanently saturated it becomes more or less fluid, yields readily to pressure, has an extremely small angle of stability, and is likely to bleed and flow underground or even to boil up in the bottom of pits, making excavation in it dangerous and costly. If the sand is very fine and there is an abundance of water it has many of the properties of real quicksand and is likely to be called quicksand even if it has not the micaceous or earthly particles that make true quicksand so greasy and slippery.

Excavation in it by ordinary methods gives a great deal of trouble and even with careful protection is likely to cause depressions in the surface of the adjacent ground or injuries to nearby structures and to require very careful and expensive bracing and sheeting for the sides of the excavation.

Most of this trouble is due to the presence of too much water in the sand and if this can be removed the difficulties will be greatly diminished. During the last twenty or thirty years many instances have been noticed where the excavation of deep pits in the lower part of Manhattan island (where many large buildings with deep foundations have been constructed in a notable quicksand area) have drained the water from the ground for a considerable distance and have thereby materially changed its character and condition. The ground water level has been temporarily lowered at nearby points during the construction of the work and in some cases it has been permanently lowered over considerable areas by a large number of deep excavations that, in some instances, have deprived foundation timber of its saturation and permitted decay that necessitated repairs, changes and reconstruction which would otherwise probably never have been necessary.

In some of the deep subway construction heavy pumping was maintained for many months and lowered the ground water level several feet, permitting work to be done that could not otherwise have been safely attempted.

At the recent excavation on the Jersey coast, mentioned on page 516, where the seashore sand was very unstable on account of saturation, a deliberate system of constant pumping from numerous points in a line enclosing the excavation a little below the bottom of the pit very rapidly drained the required area and kept it dry during the execution of the work so that no difficulty was experienced either from wet bottom or from the caving in of the sides, which became dense and stable and maintained vertical faces without the necessity for costly sheet piling and obstructing braces that would otherwise have been required.

Another example is that afforded by the construction of the outlet for the Ralph avenue storm water sewer in Brooklyn, where many hundred feet of a very wide trench was excavated to a maximum depth of 26 feet. A wide trench was excavated more than 20 feet below ground water level and the work was done without any difficulty whatever, simply by reason of the method employed of following up the excavation with open jointed wooden sheeting through which the water entered freely and was collected in open ditches left alongside the sewer and leading to sumps in which several pumps were installed and constantly operated, thus draining the sand so thoroughly that it exerted comparatively little pressure on the sides of the trench and kept the bottom dry. In this case the sand, which was a sharp and moderately coarse, excellent concrete sand, showed a steep angle of ground water surface from the sides of the trench to points near the surface of the ground where the level corresponded closely to that of the adjacent Jamaica bay.

The installation and operation of artesian wells has demonstrated some of the features of the flow of water through sand so that approximate calculations may be made of the drainage radius and of the slope of the ground water surface or water table around well points driven to different depths and operated by adequate pumps. The preliminary investigation of the site accompanied by driving well points, sinking sumps, diverting surface water and preliminary pumping might often save the engineer and contractor a great deal of time, labor, and money when excavations are to be made in quicksand.

Contractors Repudiate Compromise With Blackmailers

The Bulletin of the Associated General Contractors of America, the most powerful and high-principled construction organization in the world, says:

> The action of the Lockwood Committee now investigating the building situation in New York was endorsed at the meeting of the Executive Board in Washington, November 16, by resolutions adopted unanimously.
>
> Plans were laid for securing the co-operation of the United States Chamber of Commerce and other employers' associations in urging the Lockwood Committee to "pursue its investigation without fear or favor to the end that all guilty be exposed and punished, and that justice thereby be done to those who, condemning the purchase of immunity from labor troubles by the corruption of labor officials, desire an honorable settlement of the labor problem based upon fair dealing."
>
> The resolution follows in full:
>
> "*Whereas*, The Lockwood Legislative Committee has uncovered a corrupt state of affairs in New York City in which a group of owners and contractors has sought to prevent and settle disputes with labor organizations by the payment of tribute or so-called graft to certain labor officials; and,
>
> "*Whereas*, The same condition of affairs may exist in other lines of industry; and,
>
> "*Whereas*, This condition reflects discredit on the whole construction industry and until the matter is entirely sifted and the names of all of the guilty parties disclosed the whole industry, the second largest in the United States, is on trial and stands discredited in the eyes of the public; and,
>
> "*Whereas*, Former legislative committees, operating upon similar lines, have not always carried their investigations to the ultimate conclusion so that the guilty ones were exposed and punished.
>
> "Therefore, be it resolved,
>
> "1. That the Associated General Contractors of America is in entire sympathy and accord with the investigations of the Lockwood Committee.
>
> "2. That the Associated General Contractors of America invites the Chamber of Commerce of the Unted States, other organizations and employers generally throughout the country to join with it in asking the Lockwood Commttee to pursue its investigations without fear or favor to the end that justice thereby be done to those who condemning the principle of the settlement of, or purchase of immunity from, labor troubles by the corruption of labor officials desire an honorable settlement of the labor problem based upon fair dealing.
>
> "3. That a copy of these resolutions be sent to the Lockwood Committee, be given publicity through the press, be spread upon the minutes and sent to members of the association."

Wanaque Dam Begun

After several years of legislating and negotiating, work was begun on the Wanaque dam (described in PUBLIC WORKS, April 17, 1920), on November 23, when the first sod was turned by the presidents of the North Jersey District Water Supply Commission and of the City Commission of Newark.

The cost-plus contract will be described next week.

Legitimate Use of Water

Under the title, "What Is the Legitimate Use of Water?" C. M. Saville, manager and chief engineer of the Hartford, Connecticut, water board, presented some recent figures and a study and discussion of them before the New England Water Works Association, a synopsis of which is given in the following article. The subject is one of great interest to water works engineers in connection both with their planning for capacity of future supplies and their forming a decision as to the probability of leakage or waste in existing systems.

The primary object of a water supply is to serve the people with a necessary commodity in as economical and efficient a manner as possible. Both total amount used and rate of use are important, the former in connection with selection of drainage area or other source of supply, the latter especially in relation to the designing of distribution systems and appurtenances.

There may be an increase in per capita consumption from year to year or a difference in consumption between cities which is not due to waste but has legitimate cause. Such difference may be due to the basis on which the number of consumers is estimated, but actual increase in rates may be due to the character of the houses, developing of use of plumbing fixtures, extension of sewers and provisions for modern personal convenience, the pressure under which the water is supplied, and the requirements for mechanic arts and commercial purposes. During the past fifteen years the equipment of tenement houses with plumbing fixtures has developed greatly from the former conditions of merely a cold water faucet and one toilet to a building or a floor. These changes cause great increase in per capita domestic demand during a transition period of perhaps 20 years in suburban and country localities, and thereafter a more slowly advancing rate, tending to approach a constant rate of consumption. For the transition period the rate of increase per capita per year may be two or three gallons more than the present normal, and thereafter may drop to one-half to three-quarters of a gallon.

CONSUMPTION IN HARTFORD

The city of Hartford is practically 100 per cent metered, the only unmetered supplies being fire protection services and some use of water for street watering, flushing sewers and water mains, and fire hydrants. In 1915 an intensive study of consumption was made and it was found that domestic consumption averaged 33 gallons per capita per day, manufacturing 19 gallons, public use 3 gallons and unaccounted for 10.5 gallons; a total of 65.5 gallons. The total consumption averaged 9.40 million gallons per day. In 1919 this had increased to 11.88 million gallons and, while no close study has been made, it is believed that the unaccounted for water is less than 15 gallons per capita, or 20 per cent of the total consumption.

In Hartford the water used from the public supply for manufacturing and industrial purposes is low because much of the water so used is furnished by private supply from driven wells and streams. But for this, both the manufacturing consumption and the total would probably be appreciably larger.

Public--Water used for public supplies is believed not to exceed 450,000 to 500,000 gallons per day, or 157.5 million gallons per year, of which the fire department uses 3.7 million for station use and 3.3 for extinguishing fires; the parks use 11.7 million, the schools 24.7 million, miscellaneous buildings 20.8 million, and the street department uses 34.1 million for sprinkling and flushing and 3.1 million for other purposes; while 55.2 million is unaccounted for. The use for fire purposes is very low per year but may be high per minute. It averages less than one-half pint per capita per day. From the records of the fire department for 1914 the following figures were obtained: 628 alarms, 105 fires at which water was used, water pumped 63 times, average length of hose line 380 feet, average hydrant pressure 60 to 80 pounds. The duration of hose service averaged 15 minutes at 50 fires, 15 to 30 minutes at 25 fires, 30 minutes to 1 hour at 15 fires, 1 hour to 2½ hours at 11 fires, 2½ to 4 hours at 2 fires, and 4 hours to 6 hours at 2 fires. At only 16 fires were more than 2 streams used, at 7 fires more than 4 streams were used and at one fire 13 streams were in service.

Mr. Saville gives tabulated data for the seven fires at which more than 4 streams were in service, and these show a total amount used of 648,380 gallons as a maximum where 13 streams were used, and 35,770 as a minimum where only 5 streams were used. These seven fires used a total estimated amount of 2,182,190 gallons, or about two-thirds of the entire amount used during the year for putting out fires, leaving an average for the other 98 fires of about 11,400 gallons each. These quantities were estimated by calculations based on the size of nozzle, length of fire line and pressure. These gave a maximum rate of discharge for the 13-stream fire of 4,765 gallons per minute and a minimum rate of 1,120 gallons for 5 streams. A fire occurred in 1917 at which 13 pumping engines and a water tower were used and resulted in a loss of $613,000. Twenty pieces of apparatus were in action and in all the equivalent of 38 single streams were employed simultaneously. It is estimated that about 3½ million gallons of water were used at this fire and that for four consecutive hours the draft was at the rate of 10,000 gallons per minute. This rate, it is interesting to note, is exactly that recommended for Hartford's congested district by the engineers of the National Board of Fire Underwriters in 1916.

Unaccounted for water is due to leakage from underground water mains and services, under-registration of meters, and probably from illegitimate use and some unmetered public uses. Dexter Brackett, in his report on the Boston Metropolitan Water District, stated that 15 gallons per capita per day was a minimum which "could only be maintained by a thorough meter system and constant inspection." John R. Freeman, in his report on New York's water supply, gave 10 gallons as "the irreducible waste with every service pipe metered and most rigid inspection."

Domestic Consumption—Proper and legitimate rates of use for domestic purposes involve many factors of human habits and social requirements as well as necessities. Figures were given by Mr. Saville for five Massachusetts cities which are similar in their characteristics and are practically residential communities having no large industries and which have all been fully metered for ten years or more. In these communities the per capita consumption in 1914 varied from 40 to 65 gallons, averaging 51.8, while in 1918 the consumption had increased to from 47 to 76 gallons, averaging 62.7. This shows an increase in consumption of 21 per cent, and during the same period the population had increased 13 per cent, giving an average increase in per capita consumption of about 7 per cent. The increase in per capita consumption in the individual cities varied from 1.4 to 3.2 gallons per capita per year, or 7 to 16 gallons for the 5-year period.

Messrs. Freeman and Stearns, in reporting on the Baltimore water supply, stated that there is a strong tendency in nearly all the large American cities for the per capita supply of water to increase from year to year.

In a certain district that purchases water from the Hartford water department 1,878 persons were served by 379 connections, all metered, and the average use was 25.2 gallons per capita. By meter rates at 12 cents per hundred cubic feet and a minimum charge of $5 per connection, this district paid $3,414 for water last year, an average rate of about $9 per connection. An average of fixture rate charges paid to 27 private water companies in Connecticut similar in character to this district gave the following rate schedule in force prior to 1918: Single family or faucet $6 per year; one water closet, $4; one bath-tub, $4; two set-tubs, $1.50; sill-cock or use of hose, $5; each additional closet, $1.50 each additional bath-tub $2, horse or cow, $4. Meter rates by private water companies ranged from 25 cents to 40 cents a thousand gallons, the majority of the companies charging 30 cents. On the basis of these figures, the cost by fixture rate for a single family with 1 water closet, 1 bath-tub, 2 set-tubs and a sill-cock would be $20.50, which would give a cost per thousand gallons of 56.2 cents if the consumption were 20 gallons per capita per day, 45 cents if 25 gallons per day, 37.4 cents if 30 gallons per day, 28.1 cents if 40 gallons and 22.6 cents if 50 gallons. As compared with a meter rate of 30 cents, meter rates would apparently be cheaper for anything less than about 38 gallons per capita per day.

In the district studied, 48 premises with single faucets and accommodating 300 people, had an average daily consumption of 8.8 gallons per capita per day; of which 48, 14 had a consumption of 6 gallons per day or less and 9 a consumption of 12 gallons or over. Houses without such modern conveniences as bath-tubs, water-flushed toilets and set-tubs with running water, average about 9 gallons; while 75 fully plumbed houses in this district accommodating 312 people used an average of 28.4 gallons per day.

It would appear from this analysis that the cost of metered water is ordinarily cheaper to the consumer than by fixture rates and he is thus led to more lavish use; while on the other hand the general installation of meters tends to cut down waste of water. The net result of this may be that, while legitimate household use of water seems to be increasing, the amount pumped or drawn from storage reservoirs is only slowly affected.

Mr. Saville concluded his paper with two tables, one showing the use of water in 16 dwelling houses in Hartford of various character and conditions of plumbing, and the other giving a summary of the use of water in 661 premises of various kinds housing 5,937 people and believed to be representative of average conditions in Hartford. Of the 16 residences in the first table, the assessed valuations varied from $1,500 to $45,000, the number of tank closets from none to 10 and of flush closets from none to 7, the number of wash basins

Total and Average Consumption in Various Classes of Houses

	Services	People	Cu. Ft. per year	Per Service People	Per Service Gallons per day	Per Capita Gallons per day
Apartment Houses	9	462	1,394,300	51.4	318	62.0
Six Tenement Houses	76	1,602	1,987,000	21.0	536	25.5
Three Tenement Houses	66	828	1,145,400	12.5	355	28.4
Two Tenement Houses	208	1,543	2,268,100	7.4	223	30.0
Single Houses (3)	128	570	866,700	4.5	242	45.7
Single Houses (2)	138	743	1,630,100	5.4	242	45.7
Single Houses (1)	36	189	748,900	5.3	427	81.4
	661	5,937	10,040,500	9.0	312	34.4

from 1 to 9, of bath tubs from 1 to 7, of set-tubs either 2 or 3, of shower baths from none to 7. The occupants varied from 2 to 11. The gallons per capita per day varied from a minimum of 25 to a maximum of 133. In every case the maximum figure was for the one residence assessed at $45,000. Omitting this, the maximum consumption was 88½ gallons, with 4 tank closets, no flush closets, 4 wash basins, 4 bath-tubs, 3 set-tubs and no shower baths.

The second table divides the buildings into apartment houses, six-tenement houses, three-tenement houses, two-tenement houses and single houses. The totals and averages arranged under these several classifications were shown in the table on the preceding page.

All these premises have been metered for a number of years and it is reasonable to suppose that the use of water in them has become stable.

Water Power in Alabama

Nearly half of the state of Alabama is served with electric power by a dam on the Coosa which generates 90,000 horsepower. A new Coosa dam is being constructed and also one at Muscle Shoals, the former of which will ultimately generate 120,000 horsepower, and the latter is being equipped with machinery to generate 300,000 horsepower. Thus these two plants will add more than four times the present power consumption, giving a total of over 500,000 horsepower.

Altogether there is, it is said, more than 1,000,000 horsepower available for development in Alabama, which should serve as a great stimulant to the expansion of present industries and the establishment of new ones. The two new plants are expected to be in actual service within the next two years.

$52,000,000 Dam and Irrigation Work in India

A great dam and a series of high-level canals on both sides of the Indus river are planned to irrigate approximately 5,000,000 acres of land for food and cotton growing. The dam will be about one mile long and the two canals will supersede existing ones on both sides of the river There will also be required a levee 105 miles long for flood protection. Plans and specifications for the whole project have been submitted to the Government of India and it is expected that they will receive the sanction of the secretary of state so that arrangements for work can be begun at an early date. For work of this magnitude, even in a country where labor is plentiful and cheap, American types of construction and machinery which are unexcelled in the world should find place and American methods may justify attention of interests here that are waiting for a resumption of construction on a large scale in this country.

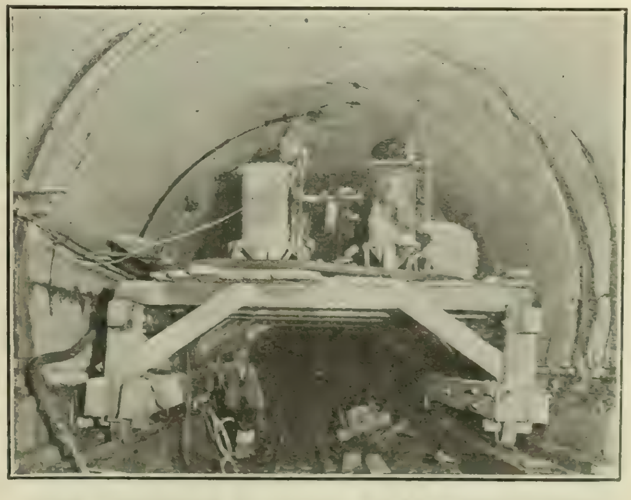
Concrete Lining For Cast Iron Tunnel Shells. III*

Grouting the concrete lining to fill the voids under the flanges of the lining rings, using 60 pounds pressure.

In all previous construction of tunnels with cast iron linings, great difficulty has been experienced in filling the concrete around the under sides of the projecting inclined webs and flanges. Concrete, especially when fine and wet, maintains a horizontal upper surface and it has always proved quite impossible, even when subjected to considerable pressure, to force it into spaces elevated above the inlet. Voids therefore are bound to appear in the triangular spaces under the inclined webs and flanges in the upper segments that project into the concrete lining.

These were, of course, anticipated and inevitably occurred throughout the 17,500 linear feet of single track cast iron lined tubes of the East river subways at 60th street, at 14th street, at Old Slip and at Whitehall street, where the 1:2:4 concrete made, with the ¾-inch aggregate and having an average thickness of 14 inches, was placed with great care and rammed or spaded wherever possible, to give it maximum density.

Although the clearances were sometimes very small, especially where there was any irregularity of alignment causing reduction of clearance between the forms and the edges of the ribs and flanges, the concrete was so carefully placed that a smooth, dense arch soffit was secured and efficient measures were taken to locate and fill all of the small voids near the extrados of the arch.



HIGH PRESSURE GROUTING PLANT WITH TANKS AND COMPRESSOR

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*Part I, Mixing and Transporting Concrete, was published September 18, and Part II, Steel Forms, Travelers and Concreting, was published November 13.

SPECIAL CONNECTION FOR GROUTING AND VENTING VOIDS IN LINING

The cast iron lining rings were assembled with key panels and plate panels alternately at the crown. The former arrangement was such that there were always in each ring three segments with voids under the upper flanges, thus necessitating the drilling of three grout holes. In the plate arrangement there were only two inevitable voids and only two grout holes were therefore always necessary, and were made singly or in pairs according to the methods employed.

After the forms were stripped, the smooth and uniform surfaces of the concrete were everywhere carefully examined and sounded to detect any hollow or unsound places, and where these were visible, the defective portions of concrete were cut out and replaced. Where they were not visible but were indicated by tapping or other methods, holes were drilled and as much grout was forced in under pressure as could be received.

In some cases provisions were made for marking through the forms, on the fresh concrete, the location of ribs and flanges situated so as to obstruct the concrete and probably cause voids. In other cases where this was not practicable, after the forms were stripped, measurements were made from fixed points to locate such places and they were marked and all of them were drilled to permit the insertion of the grout tubes.

GROUTING INSIDE CAST IRON LINING

Grout, made with neat cement mixed by hand and hand pumped, was mixed to a soupy consistency in machines of the pneumatic and paddle wheel types, and forced under about 60 pounds pressure into the cavities in the lining which on the average required about 1¾ bags of cement per linear foot of tunnel.

At some of the points located for grouting, as in the 60th street tunnel, a single 2-inch hole was made through the concrete lining by a jackhammer drill operated by compressed air, and in it a steel nipple was inserted and tightly calked with oakum. To this nipple there was connected a sleeve with a short length of 2-inch pipe terminating in a Y with one branch reduced to receive a ¾-inch vent pipe and stop cock, and the other connected to a 2-inch coupling that later received the grout pressure pipe. In other places, comprising a large proportion of the work, two holes were drilled into each cavity, one used for filling and the other for venting and thus dispensing with the Y fittings.

After a sufficient number of these connections had been set, the grouting gang of five men injected grout under pressure into each cavity and when it would receive no more grout, closed the valves so as to maintain the pressure; when the grout pipe was removed, connected to another nipple and so on, until all had been served at the rate of about 100 linear feet of tunnel in two or three days. Usually one grouting sufficed, but in some cases the cavities were grouted a second time.

In most cases the grout was mixed by hand and was forced into the lining by hand pumps. In other cases, it was mixed under high pressure in Caniff grout tanks provided with air from a Westinghouse compressor, the plant being on East 60th street. In this case the tanks were cross-connected so that they could be used independently or in combination, and so that one would afford a reserve, permitting the other to be put out of service without stopping the work. The Ransome-Caniff grout mixer and placer was also used in the Montague street tunnel.

Rails were laid on the lower benches of the duct banks, making a track of about 12-feet gage on which there were installed small wooden gantry travelers mounted on four wheels giving full horizontal clearance and about 8 vertical feet clearance for cars and locomotives under them. The traveler caps carried horizontal platforms at about the springing line. Some of these travelers were used merely for working platforms for drilling the holes and inserting the grouting nipples, and others were used for the grouting gangs and their equipment.

The tunnel lining was executed under the direction of D. L. Turner, chief engineer, Robert Ridgway, engineer of subway construction, and of C. M. Holland and C. D. Drew, successively in charge of the Tunnel Division. All of the different contracts here mentioned were awarded to Patrick McGovern & Company and to Booth & Flinn, Ltd.

Delaware State Highway Department II*

Organization of department; division into bureaus of survey, design, construction, maintenance, general office, and economics, working force and equipment.

The Highway Department of the State of Delaware which, as stated in the previous article, was created in 1917, consists of the Governor, John G. Townsend, chairman, and four other members. The principal officers are Charles M. Upham, chief engineer, and George W. Francis, secretary, and a staff at present consisting of about seventy persons at headquarters in Dover and, most of them, located throughout the state. The secretary is officially in charge of auditing the finances of the department and, with the chief engineer who is the administrative head of the department, is directly responsible to the State Highway Department and through it to the General Assembly and the people of the state. The department is divided into seven bureaus, each in charge of a division engineer acting under the direction of the chief engineer or of principal assistant engineer Samuel Knopf.

The *Bureau of Surveys* in charge of Arnold Richardson, assistant engineer, has two or more survey parties in the field as required, with necessary draftsmen and clerks in the general office.

The *Bureau of Design* in charge of assistant engineer C. N. Conner makes the plans and estimates for new construction, including drainage. Plans are laid out according to the latest methods adopted by Federal Government and closely follow their standards, the one exception being design of bridges and culverts, which, on account of the smallness of the state, all are given individual designs.

There are maintained complete record charts of each finished road, which make it possible to analyze any job long after it has been completed. These post mortem charts give the length of slabs, the date laid, maximum and minimum temperatures, location of joints and cracks, kinds and proportion of all materials entering into the slab, condition of sub-grade, and direction of mixer. All additional cracks, as they develop from year to year, are put on these charts, showing a comparison of slabs with and without reinforcement, number of cracks in certain slabs against number of cracks in slabs of various lengths, and comparison of slabs with and without lime. There are charts showing different contracts but using the same kind of materials, same proportions and sub-grade condition and the same length of slab, which are observed for a period extending over fifteen or twenty days. It is found that, regardless of the length of slabs, the number of cracks will follow in close proportion, depending on the maximum and minimum ranges of temperature during the period. Construction charts graphically illustrate the entire job with a legend of just what materials entered into the contract. Experimental charts define movement of slabs that have been measured monthly by a Bureau of Standards man, and the variations recorded. Other charts show the use of lime and concrete. Considerable study has been expended along this line for the development of a better concrete.

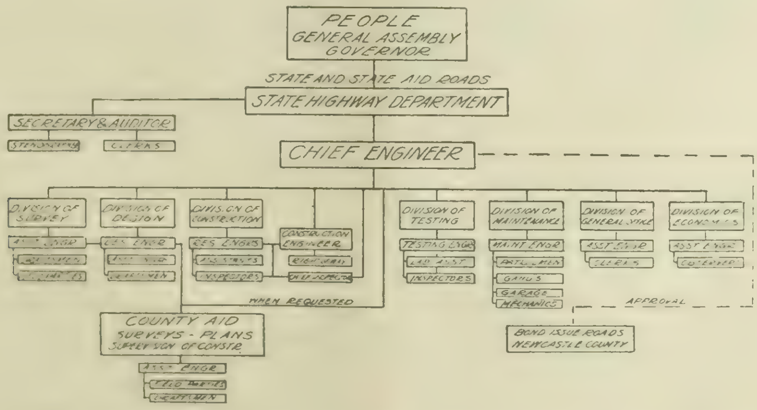

CHART OF ORGANIZATION OF DELAWARE STATE HIGHWAY DEPARTMENT

There is at present a force of nine resident engineers, each of them supervising from one to six contracts with from one to four inspectors, many of them technical graduates selected with great care and encouraged to make their best efforts by being promoted, as rapidly as their merits justify it, to positions of resident engineers.

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*Part I, history and development of departments, was published November 13th.

The *Bureau of Maintenance* is in charge of assistant engineer Elmer V. Cushman, who is also in charge of the Federal Aid Equipment.

Each road is identified by a route number and is divided into 1-mile sections.

All of the work is accounted for under specific headings such as roadway metal, shoulders, roadside and guard rails, ditches and drains, bridges and culverts, materials, sundries and supplies, cost per mile, cost per square yard, etc., and an accurate record is kept of the different items, including the plan and profile map, date and descriptions of operations.

The *General office Bureau* in charge of assistant engineer I Paul Jones, preserves all of the records and accounts, complete summaries of which are always instantly available. Minute histories of every contract, including classified costs, are kept in a ledger and all available data are kept posted up for the most convenient reference. This is done so thoroughly and promptly that the condition of every contract for the previous day is always known in the main office.

The *Bureau of Testing,* in charge of assistant engineer G. W. Hutchinson, is equipped with a laboratory and inspectors that have charge of testing all materials used in road construction. It passes on the quality of all materials purchased or used, and conducts researches and experiments. All of the ingredients, concrete, water, sand, stone, lime and cement are required to conform to the best standards and are thoroughly tested for chemical and mechanical results. The cement is subjected to compression and boiling tests, and comparative tests are made of road concrete taken from the structure and of those made at the laboratory.

The *Bureau of Economics* is in charge of assistant engineer W. W. Mack, who is also in charge of the Department of Right of Way and of Information. This bureau provides lectures illustrated with stereopticon slides, showing improved roads and operations; furnishes information published in the road bulletin of the Delaware Automobile Association giving the state of progress of different sections of road work, resurfacing and the like in Delaware and in contiguous parts of Pennsylvania and Maryland, with information concerning detours, closed roads, and the like. It has also prepared a public exhibition of road models, including a display of all tests now used in the department.

POST MORTEM RECORDS

The Delaware State Highway Department was the pioneer in devising and using what is called the "post mortem record," by which is maintained an up-to-date complete detailed history and chart by which every job can be analyzed at any time. Among the data recorded are the general date of the work, and length of each slab laid, the number of cracks and their location, the kinds of materials used, the proportions of materials, the conditions of sub-grades, weather conditions, maximum and minimum temperatures, use of hydrated lime, use of reinforcement, operation of mixer, and the name of inspector.

It is thus possible, after completion of a job, to detect and analyze faults, while no method has been discovered for the complete prevention of cracks in long monolithic concrete, 50 per cent of them can be eliminated by good materials and good workmanship, and none need occur in slabs less than 100 feet long. The longest slab on record without a crack is 330 feet.

FORCE AND EQUIPMENT

It is the policy of the department to co-ordinate with technical training institutions and to make the qualifications for members of the engineering staff more exacting as the standard of highway engineering is developed. Definite training of a high grade is now required of all employees except laborers, and a system has been inaugurated for the employment during the summer of students specializing in highway engineering at Delaware College. Great pains are taken to promote personal ambition and zeal and *esprit de corps* among the staff by official encouragement, recognition and assistance. Staff banquets are held four times a year and there are weekly social gatherings.

During the summer of 1920 the average force consisted of nine resident engineers, one hundred inspectors, and one motorcycle policeman for every five to ten miles of improved road; and also, at headquarters, a draftsman and six stenographers and clerks.

The mechanical equipment included 4 two-passenger and 20 five-passenger automobiles; 37 automobile trucks of 2-ton capacity, 10 of them having hand-dump bodies, and all but three being equipped with solid tires; three-120 h.p. Holt tractors; one Warren Brothers No. 6 portable asphalt plant; one 3-bag Ransome building concrete mixer; one stiff-leg wooden derrick and hoisting engine; one locomotive crane for unloading, and one gasoline operated trench digger for drainage work.

For the operation of this equipment there was maintained a force consisting of 6 foremen and about 18 men distributed at convenient localities throughout the state to give immediate attention to necessary repairs and maintenance, all new construction work being executed by contract. It is intended to install as soon as practicable sand and stone storage at five different points and to build a garage and repair plant provided with an adequate force of competent mechanics.

DEPARTMENT FUNDS

The regular funds for the maintenance of the department are derived from automobile registration fees and licenses and from the excess state income tax revenue over $250,000. The rapid increase in the number of automobiles owned and operated in the state have proportionately increased the road income from $35,672 in 1914 to $286,332 in 1919 and $327,634 in the first six months of 1920. This revenue must provide for the maintenance of roads, for the maintenance of the highway department organization and for the fixed charges on the bonds issued. An income of approximately $60,000 per year is available from the income tax. Construction is provided for by 40-year sinking fund bonds, of which $1,100,000 have already been issued. During 1919 there was available from state money $1,500,000 and an equal sum was contributed by General T. Coleman du Pont, making a total of $3,000,000. The present organization has facilities for executing about $5,000,000 worth of work per year.

Excavating and Loading Beyond the Reach of a Ditcher Machine

An excavation 18 feet deep for the bridge approach of a logging track near Shelton, Wash., was made with an American road builder and ditcher and a small drag-line machine.

The ditcher first made a cut 10 feet below the rails of its own track and dumped the material in cars on a bank 24 feet above its track. These dimensions of digging and lifting reached the maximum capacity of the machine.

Special provision was therefore necessary to dispose of the spoil for the second cut of 6 feet. This was provided by building on the bottom of the trench cribbing 6 feet high, made of old railroad ties. Five cribs were built, and sectional tracks laid on them on which the ditcher machine was operated with plenty of reach to excavate 6 feet below the base of the cribs and still to dump into the spoil cars on the top of the bank.

While the spoil cars were being dumped the cribs were shifted ahead, all of the ties for one crib being handled in two bundles by the excavator itself. The spoil cars were returned and the cribs and track shifted with an interruption to excavation of only fifteen minutes. The cribs were spaced 3 feet apart in the clear and the bed of each crib was leveled by four men who prepared and built the cribs with great rapidity.

The material handled consisted of 6 feet of loose top soil overlaying 10 feet of hardpan that, for the second movement of the ditcher, had to be blasted.

The spoil was loaded into 6-yard hand dump cars and deposited in a fill 2,000 feet long at the opposite end of the bridge. The machine excavated 450 yards daily for 21 days, loading a train of six 7-yard cars with 84 passes of the dipper in eight minutes. The 2 feet of sandstone in the bottom of the trenches was drilled, blasted and removed by the drag-line scraper bucket that, on account of obstructions, handled it twice and at a speed only one-fifth that of the ditcher machine.

Replacing Bridge Truss Bearings in Service

The 5½ by 7½-foot by 12-inch base plates under the truss shoes of the Wabash Railroad bridge across the Mississippi river at St. Charles, Mo., were recently replaced by grillages of 12-inch I-beams without interrupting the service of the bridge.

Each of the two cast-iron base plates at one end of the 300-foot span rested on an 8 x 8-foot masonry shaft 30 feet high on top of a masonry pier about 70 feet high above rock bottom. As there was no room for lifting apparatus or clearance for removal of the plates on the tops of the shafts, and as the elevation was so great as to make the construction of ordinary falsework costly, a special lifting harness and jacking platform were devised that saved time and money and enabled the work to be safely accomplished in a simple manner.

In planes parallel to the bridge axis, sets of four 12 x 12-inch vertical wooden posts were placed on each side of each of the masonry shafts, capped with 12 x 14-inch timbers flush with the top of the masonry, and connected together by transverse timbers, thus virtually forming falsework towers enclosing the masonry shafts.

On the 12 x 14-inch caps, eight 100-ton hydraulic jacks were set to support, for each truss, the ends of a pair of 24-inch transverse I-beams clearing the inclined end posts and carrying pairs of 12-inch longitudinal channels with ½-inch hanger plates bolted to them and bored at the lower ends to engage pilot nuts screwed to the ends of the end lower chord pins.

With this apparatus the 200-ton span was raised sufficiently to permit the longitudinal withdrawal of the old base plates, which were jacked out onto a suspended platform, after which the new grillages were rolled in from this suspended platform. The work was done by the Kansas City Bridge Co.

Six Million Dollar Canadian Pier

A $4,500,000 contract has been awarded for part of the construction of the Ballantyne pier on Burrard Inlet at Vancouver Harbor, B. C. The pier, which will probably be completed within two years, will be 1,206 feet long and 341 feet wide with four 500 x 110-foot two-story steel sheds. The reinforced concrete pier will be supported on 7-foot cylindrical piers sunk to rock bottom and extending to a height of 45 feet above low tide. It will have double tracks on the outer edges and four tracks through the center, and will be equipped with improved heat and light and mechanical apparatus, such as unloading cranes, cargo chutes, elevator and esculators. It will have capacity for loading and unloading four large vessels simultaneously.

Coaling a Drag-Line Excavator

A Class 24 Bucyrus drag-line excavator used by the Gail & Regan Company, Chicago, contractors for excavating a 12-mile channel in Cottonwood Creek, Kan., was advantageously coaled by lifting the truck body filled with coal from the running gear by means of two chain slings attached to the boom of the drag-line machine, which hoisted it, rested the rear end of the body on the bunker and elevated it until the coal was dumped into the bunker, then returned the body to the truck frame; all in 5 minutes, as compared with about 30 minutes required for ordinary unloading.

Installing a Steam Shovel in a Deep Quarry

A 14-B Bucyrus steam shovel owned by the Wauwatosa Stone Company of Milwaukee was recently installed in their quarry by lowering it in sections from the top of the vertical quarry face 75 feet high.

A pair of vertical shear legs equipped with heavy tackle was erected at the top of the quarry face and first lowered the 11,800-pound shovel base and set it in position ready to receive the revolving frame. The ventilator was taken from the frame and the hook of the hoisting tackle was lowered through the frame and fastened to the lower part. The frame was hoisted by mule power and the shear leg back stays were slacked off until the top of the shears overhung the quarry face and the 19,800-pound frame was lowered to position on its base. The time required for erecting the shear legs and lowering the shovel was about two days.

More New Piers for New York

The Cunard Steamship Line has announced preparation of plans for the erection of eight 1,000-foot piers and one smaller pier at Weehawken. They will cost about $30,000,000. Their frontage, which has already been secured, is at present obstructed by a number of sunken wrecks. The first step will, therefore, be the removal of these obstacles and dredging to give proper deep water facilities.

Dock Commissioner Murray Hulbert has announced a municipal project for the construction of three docks 350 feet wide and from 700 feet to 1,000 feet long at Owl's Head Bay, Bay Ridge. They will be equipped with modern apparatus for cargo handling. The New York and New Jersey Port Commission has completed its report, including plans for extensive Staten Island and East river improvements.

It is authoritatively reported that in July the cost of production of lumber in large representative mills varied from $30 to $32 per thousand, showing an increase of more than 20 per cent in the last year.

It is officially reported at the hearings of the United States Senate Committee on reconstruction that the cost of construction work in Cleveland has advanced 167 per cent in the last five years.

Work on the Three-States Road Started

Work has been started on what is known as the Three-States road, which is the name given to a highway leading from Mountain Rest, S. C., to Highlands, N. C., which latter is said to be the highest incorporated town east of the Mississippi, being 3,820 feet above sea-level. This road is about 20 miles long, and will be confined to the Nantahal National Forest and will pass through parts of North Carolina, Georgia and South Carolina. The cost is estimated at $220,000, which will be paid partly by the United States Forest Service, partly by Macon county, N. C., and partly by Oconee county, S. C.

New Jersey Roadwork Stopped by Injunction

The million dollar road construction program in Essex County, N. J., has been stopped by a temporary injunction granted October 29 to give opportunity to review the board's awards of contracts. All the contracts let are affected by this injunction except one contract which is now nearing completion. This however will not prevent the municipalities in the county from going forward with preliminary steps now under way, such as the preparation of cost sharing agreements, setting of curbs and making connections with sewers and other public utilities in the streets to be paved.

The counsel for the Chamber of Commerce of Newark who asked for the writ, advanced eight specific reasons but the writ was granted on the first alone, this being that the freeholders of the county were required by law to provide the funds for financing any improvement before they let the contract for it, and the court held that until the bonds actually are marketed the county cannot tell whether or not it has made an appropriation sufficient to meet the cost of the improvement, and that as the bonds have not yet been marketed for this work, the contracts cannot be let legally. The court believes that it was the intention of the law makers to provide that the actual money should be in the county treasury before the contracts were let.

Pumping Eliminates Sheet Piles

The construction a year ago of the $1,500,000 Ambassador Hotel Annex, Atlantic City, involved a 150 x 300-foot excavation 18 to 24 feet deep through wet sand near the shore line of the Atlantic ocean, ground water being encountered about 10 feet below the surface of the ground.

The obvious method of holding up the sides and excluding the water by steel sheet piling was replaced by a system of sub-surface drainage, maintained during the construction work and for a very short period in advance, that kept the excavation dry and made the sand itself so dense and firm that it stood well with vertical faces without sheeting or bracing.

The site was enclosed by a 4-inch pipe line 2 feet below the surface of the ground, in which were inserted 2-inch nipples and tees 4 feet apart, connected by steam hose to 20-foot lengths of 2-inch pipe terminating in 6-foot well points driven and jetted down below the bottom of the future excavation.

The 4-inch pumping main was divided into independent sections by shut-off valves so that suction could be concentrated on any portion of it. It was operated by four triplex pumps that were kept running until the sub-structure walls and floors were built and waterproofed and a permanent drainage system of 6-inch pipes in graveled trenches were laid and connected to a sump. The Thompson-Starrett Company was the general contractor.

Immigration Notes

In a recent article in the "Brooklyn Eagle," the probable number of immigrants for the next year, 1921, is estimated at 2,000,000, about 90 per cent of which will enter through Ellis Island. Commissioner Wallis, in charge there, is quoted as saying that he prefers to refuse admittance to nine hundred and ninety-nine worthy immigrants rather than take the chance of admitting one unworthy immigrant. His slogan being: "When in doubt, deport."

The country needs almost unlimited numbers of efficient skilled and unskilled laborers who are willing to be Americanized and give honest reliable services. We do not need soap-box orators, radicals or people coming here with the purpose of getting the highest possible pay for the smallest possible services. It is estimated that, excluding women, children, old people, and other non-workers, only one-third of the immigrants now arriving are "workers with hands."

The greatest attention should be paid to the health and character of immigrants so as to exclude diseased, defective and vicious, particularly Bolshevists and I. W. W.'s. It is reported that fully 8,000,000 Germans are anxious to immigrate to the United States as soon as they will be permitted to enter.

There is a strong demand for desirable immigrants for farm work in the Northwest and the governors of Minnesota, Wisconsin and North Dakota invite them to come, and offer inducements to them. Wisconsin has a fund of $25,000 per year to assist immigrants and Minnesota has half a million acres of land open for homestead entry and nearly two million acres of unsold state land suitable for farming and vegetable growing at a minimum price of $5 per acre, payable 15 per cent down and the balance within forty years.

During 1919 the proportion of African negroes among the immigrants was seven times as large as that of Mexicans and eighteen times as large as in 1913.

The proportion of immigrants from South Europe has decreased and that from Great Britain and France has increased about four times.

During the week ending October 31, 26,,832 immigrants arrived in New York.

The authorities at Ellis Island have received numerous letters from different parts of the United States inviting immigrants to come there at wages as high in some cases as $8 per day, which were offered for a hundred coal miners at Valesai, Ohio.

LABOR NOTES

The Bureau of Labor Statistics, United States Department of Labor, reports that on August 31, the prevailing rate of hourly pay for union carpenters varied from $.75 in Memphis, Reading and Savannah to $1.25 in Cleveland, Pittsburgh, and St. Louis. For cement finishers from $.75 in Memphis, Reading and St. Joseph to $1.25 in Cleveland and St. Louis. For electricians $.75 in Louisville to $1.25 in Chicago, Omaha, Philadelphia and St. Louis. For hod carriers from $.40 in Atlanta to $1.10 in Philadelphia For laborers $.40 in Atlanta and Louisville to $1 in Chicago and Detroit. For lathers $.30 in St. Joseph to $1.25. For painters $.75 in Louisville, Reading and Atlanta to $1.25 in Chicago and St. Louis. Plasterers from $1 in six cities to $1.37½ in St. Louis. For plasterers' tenders from $.45 in Erie to $1.25 in Detroit. For bricklayers from $1 in Buffalo to $1.50 in Pittsburgh. For elevator constructors from $.70 in Erie to $1.75 in four cities. For gas-fitters from $.70 in Grand Rapids to $1.25 in five cities. For hoisting engineers from $.60 in St. Joseph to $75 per week in Detroit. For marble cutters from $.65 in Indianapolis to $1.30 in Philadelphia. Marble setters $.81 in Grand Rapids to $1.50 in Buffalo. Masons from $.90 in Cincinnati to $1.30 in Philadelphia. Plumbers from $1 in ten cities to $1.25 in six cities. Roofers from $.40 in Memphis to $1.20 in Chicago and Reading. Steamfitters from $1 in ten cities to $1.25 in eight cities. Stone cutters from $1 in fourteen cities to $1.25 in four cities. Structural iron workers from $.65 in Grand Rapids to $1.25 in eleven cities. Tile setters from $.90 in Grand Rapids to $1.35 in Buffalo.

In the last of October cuts of 15 to 20 per cent in the pay of the employees of textile mills in several places in New England were announced and it was stated that the Fall River mills were running at only 40 per cent capacity. It is expected that there will be a general wage reduction through the entire textile industry in New England. This will probably result in considerable unemployment and should increase the supply of labor and mechanics for other pursuits.

Report on Strikes

The Bureau of Statistics of the United States Department of Labor published a record of the strikes reported for the first six months of 1919 and 1920 which are, respectively, 1,544 and 1,813, thus showing an increase of 17 per cent over last year. These figures, however, include the number of lockouts reported which are comparatively insignificant, amounting to only 4.6 per cent for 1919 and reduced to 2.5 per cent for 1920. During the months of April, May and June there were 181 strikes and lockouts in Massachusetts and 179 in New York, 82 in Illinois, 75 in Ohio, 72 in Connecticut and 71 in Pennsylvania, 53 in Rhode Island and 40 in New Jersey; fourteen other states had from 10 to 25 in each, and twenty-three states and territories together had 120.

In New York there were 76, in Chicago 43 and in Boston 19. The total of 1,166 strikes and lockouts for April, May and June included 228 for the building trades, 100 for the metal trades, 112 for the railroad employees, 69 for freight handling and teaming, 25 for miners, 24 for street railways, 18 for stone workers, 13 for shipbuilding, 16 for light, heat and power, 15 for street and sewer employees.

An average of 985 employees were concerned in each of 587 strikes.

Five hundred ninety-three strikes were for increase in wages, 38 for decreased hours, 97 for increase of wages and decrease of hours, 70 for recognition of union, 37 for recognition and wages, and 42 were sympathetic strikes. Eighty-one were reported as resulting in favor of employers and 67 in favor of employees, while 105 were compromised. The total number of days lost during the quarter was 5,297, which, estimating an average of only 500 each, would result in a total of more than two and one-half million days lost in three months.

The strikes involving the largest number of employees were those of the timber workers in the West and Northwest, 60,000; Kansas miners, 40,000; New Bedford mill hands, 20,000; Philadelphia carpenters, 10,000; Central New York building trades, 13,000; Cincinnati machinists, 10,000.

Labor Unions May Be Held Responsible

Two very important suits for damages against the United Mine Workers of America for heavy damages on account of rioting, bloodshed and property destruction by these unions in opposition to the open shop policy of the Coronado Coal Company of Arkansas and a similar case in Pennsylvania have been in litigation in the lower Federal courts for six years and have resulted in verdicts of conspiracy and penalties and costs aggregating more than $1,000,000. They have been appealed and re-appealed, and at last they have reached the Supreme Court of the United States, and the last appeal by the United Mine Workers involving the deposit of more than $1,000,000 of the union funds to guarantee payment of the judgments if the unions loose the case. If the judgment is finally upheld, all the members of a union may hereafter be held accountable if it can be shown that a conspiracy had existed in restraint of trade, contrary to the Sherman Act.

The affirmation of the judgment will go far to show justice for all and reasonable protection to the public and to employers and will strongly discourage future strikes and interference with business.

Criticisms of Government Contracts and Specifications Invited

During the month of June the construction department of the United States Army requested bids for seventeen large projects, all for more than $100,000, with a total cost of over $8,000,000. The fact that only sixty-two proposals, made by not more than fifty general contractors, were received was interpreted to indicate dissatisfaction with the circumstances surrounding the work in consequence of which L. L. Calvert, lieutenant-colonel, Q. M. Corps, has written an open letter to General Marshall, manager of the Associated General Contractors of America, in which he states that it would be to the mutual advantage of the contractors and the government to determine what are the objectionable features of this work so that they may, if possible, be eliminated and larger competition secured. He requests the members of the association to criticize the government methods of inviting proposals, of writing specifications, of awarding and drawing up contracts and of handling the work in the field.

The association has published the letter in a bulletin and urges the expression of views based on information from original sources. He suggests the separation of criticisms on administrative powers, from those on contracts and specifications, the latter being more promising for points of attacks that may afford opportunity for action.

High Explosives Available for Blasting

Frank Page, chairman State Highway Commission, Raleigh, N. C., offers for sale at a moderate price a large quantity of "Modified T. N. T." that has been received from the Federal government and is suitable for ordinary blasting operations. It is put up in 100 1-pound cartridges to the case, can be handled with no more risk than ordinary dynamite, and has been found far superior to 40 per cent dynamite for removing rocks and stones. It is exploded by ordinary detonators and is offered for road work in lots of 1 ton or more at 22 cents per pound, and in smaller quantities at 25 cents per pound, f. o. b. cars Raleigh.

Increasing Volume of Railroad Transportation

The highest recorded volume of freight traffic ever transported in the history of the Pennsylvania Railroad System was handled during the month of October. Reports from all divisions show that during the month an average of nearly 24,000 loaded cars per day were forwarded to their respective destinations. This represents over 6,000,000 tons a week loaded on the Pennsylvania Railroad or accepted by it from connecting lines.

Proposed $100,000,000 Waterfront Improvement

The Board of Estimate and Apportionment of New York City has received a proposition for the construction of $100,000,000 improvement of 950 acres of unimproved swamp and meadow land belonging to the city on the shore of Jamaica bay. If the proposition is accepted it is intended to expend $14,000,000 in the immediate construction of 5,000 feet of bulkhead, six 1,000-foot piers, and in dredging, filling and the building of necessary warehouses, streets and industrial plants that will be continued until the completion of the entire development, possibly within ten years.

The land is at present unoccupied and useless and was acquired by the city in 1910 without cash investment. According to this plan an annual rental of $25,000 is offered to the city and the reversion at the end of a fifty-year lease of the entire tract, which, it is estimated, will then, with its improvements, have a value of $125,000,000.

This offer has been made by A. H. Greeley of Cleveland, president of the American Chain of Warehouses operating warehouses in more than 100 cities throughout the country. The proposition has been referred to a special subcommittee consisting of the president of the Board of Aldermen from the borough of Brooklyn and Queens, the deputy dock commissioner, Congressman William B. Cleary and Charles G. Bond.

Municipal Ownership in Newark

On November 2, the voters of Newark, N. J., approved a proposition for municipally owned gas, heating and power plants, it being reported that there was a majority of nearly 5,000 out of 65,000 votes on the subject. Local papers express the belief that this vote was caused largely by the poor quality of gas which is being supplied by the Public Service Gas Co., a corporation which supplies both gas and electricity to a large part of the northern section of New Jersey. There would seem to be no question that a provokingly poor quality of gas has been furnished to the score or more of communities served by this company since the State Public Service Commission gave it permission to lower the quality of gas and at the same time increase its rates very materially. As one of the local papers remarks editorially: "It is not likely that the populations of American cities generally favor municipal ownership propositions except as a measure of last resort. When private corporations fail to give good service or service at a reasonable cost, then the people turn toward municipal ownership."

Ditching With Dynamite

About ¾ of a mile of drainage ditches in the New Hanover Co. drainage district of North Carolina is being excavated by blasting with 2,000 pounds of dynamite. The work started on November 4, under the supervision of George R. Boyd, senior drainage engineer of the United States Department of Agriculture. The public, and especially the farmers of the district, have been invited to witness these operations in order that they may learn how to use dynamite in ditch excavation with a view to their adopting it for their private farm drainage ditches.

Favor Federal Department of Public Works

Hundreds of business organizations throughout the nation voted in a referendum on the Jones and Reavis bill for the establishment of a department of public works. Votes were received from 45 states, the District of Columbia, Hawaii and the Philippines. Of the total votes cast, 827½ favored the establishment of a Federal Public Works Department, with 549½ votes against it. The vote also favored the formation of the departmen by the reorganization of the Department of the Interior, the idea being to change the name of this department, and to exclude from it all nonrelated bureaus and offices.

Missouri's Road Bond Issue

Missouri voters have approved an amendment under which Missouri hopes to begin constructing a real road system next season. The bonds to be issued for constructing the roads will be paid for, both principal and interest, by licenses for automobiles, it being apparently certain that such licenses will be more than sufficient for this purpose. There have been issued this year more than 292,000 automobile licenses in the state and the license fees have totaled more than $2,000,000. Of the total number of licenses, the city of St. Louis has taken out less than 18 per cent, showing that the country districts are even more interested in good roads than the large cities.

New Jersey Highway Commission

Th new State Highway Commission of New Jersey is endeavoring to improve and enlarge the provisions for maintaining the highways under its control and in connection with this is about to install five weighing scales in different parts of the state to assist in keeping truck loads within the legal limits. The State Highway Engineer, Thomas J. Wasser, advised the board that in order to keep the snow removed from the highways this winter it would be necessary to purchase 55 snow plows in addition to the 22 already owned by the highway department, and the commission authorized the engineer to advertise for such plows. At the same meeting, on October 27, the commission adopted its construction plan for the year 1921, including about 32 miles of highway and 14 bridges, in addition, of course, to the regular necessary maintenance.

The New Jersey State Highway Commission has approved the 1921 program calling for about four and one-half million dollars' worth of road construction, including one and one-half million dollars for the Amboy bridge.

Philadelphia Municipal Asphalt Plant

What is reported to be the largest municipal asphalt repair plant in the country is now nearing completion in Philadelphia. The daily capacity is given as 3,700 square yards. The final shipment of the material for the plant reached Philadelphia on November 6, this being two mechanical mixing units, received from the Iroquois plant of the Barber Asphalt Paving Co.

While the plant is rated at a capacity of 3,700 square yards, it is estimated that 4,000 square yards of completed pavement can be turned out in a day. The plant is to be used for patching work only and not for new construction.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

Protecting Concrete From Frost III*

Enclosing the forms and heating the enclosed air.

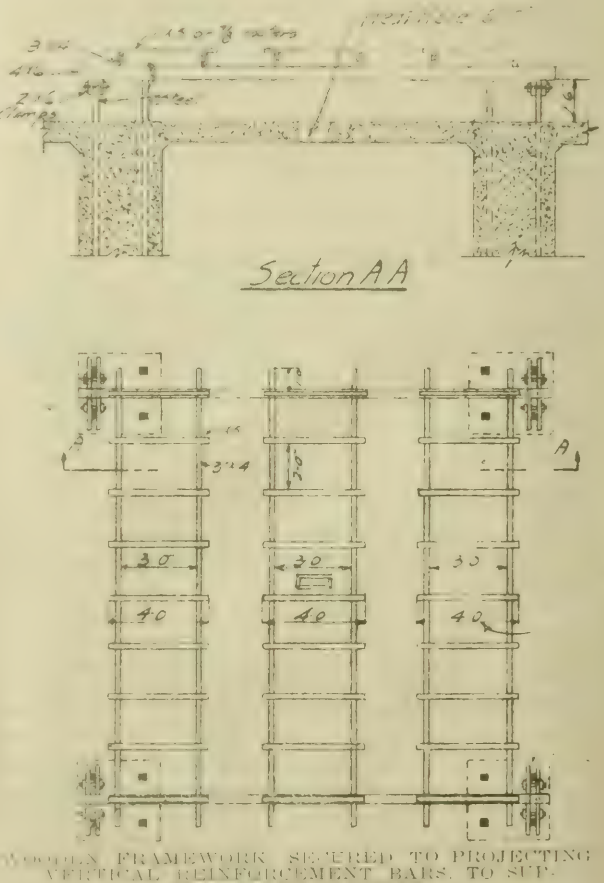
Concrete forms should always be entirely free of snow, dirt and rubbish when the concrete is placed in them, and on this account the bottoms of tall forms, as those for columns, piers and very large girders, should be accessible and are often provided with small doors or hand-holes through which rubbish can be removed just before the concrete is placed. Forms should never be allowed to fill with snow, and if ice forms in them it should be removed completely and the forms warmed, which is most easily done with a jet of live steam just before the concrete is placed. In very cold weather dry forms also should be warmed by live steam, especially if they are made of steel.

Very large forms may be warmed by salamander fires in or near them, and smaller forms, like those for columns and struts, may sometimes be warmed by placing a torch or large lamp in the lower part, in which case the top should be covered to prevent the escape of the warmed air.

Exposed constructions like arches, piers, columns and new buildings should be wholly or partly enclosed in cold weather so as to protect the concrete for several days after it is placed.

Tarpaulins or large sheets of heavy canvas with short, strong cords attached at frequent intervals on all the edges, are convenient, efficient, economical and most generally used as curtains, walls and roofs for protecting the exteriors of large concrete structures. Any required area can be covered by them if there are a sufficient number of pieces to be added successively, wide overlaps being always made between two successive pieces so as to prevent the escape of warm air at the joints. The tarpaulins, singly or in multiple, can be easily stretched across the tops of open forms and fastened to their sides to protect roof and floor slabs, large piers, columns and girders.

Tall structures like smoke stacks, towers, standpipes and other reinforced concrete units that are concreted in upwardly sliding forms, are usually provided with a movable scaffold and hoisting apparatus that travels up on the forms and affords an excellent support for the canvas covering the top of the concrete as well as for the canvas curtains that overlap the top cover and are firmly secured to it and to each other, and are well tied at the bottom and if necessary at intermediate points, to resist wind and storms and to prevent any air spaces from being opened.



WOODEN FRAMEWORK SECURED TO PROJECTING VERTICAL REINFORCEMENT BARS, TO SUPPORT CANVAS COVER

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*Part I, Effect of frost on concrete, [illegible] and protecting green concrete, [illegible] Part II, [illegible] published [illegible]

Spaces should be left between the curtains and the outer faces of the vertical walls to provide for air circulation, and the air on both sides of the walls should be kept hot for several days after the concrete has been placed. If it is a hollow structure with windows, doors or other openings in the exterior walls, it will suffice to heat the air in the interior and permit it to circulate through the holes, but if the walls are solid it is necessary to leave temporary holes in them a foot or two square, through which the air may pass and which are afterwards filled with concrete held securely in position by the tapered sides of the hole which is made smaller on one side than on the other for this purpose, and by reinforcement rods built into the original concrete and crossing the openings. If openings are not provided in the walls, it will be necessary to heat exterior and interior air by separate methods.

When concrete buildings are erected in cold weather it is often sufficient to enclose the outer wall of the last story concreted with canvas curtains and place canvas over the top of the last floor concreted, allowing them to remain in position several days while the air within is kept at a temperature of 60 to 80 degrees until the concrete is set and well hardened.

If the weather is very cold it will be necessary to enclose the last story concreted and the one next below it with curtains and to maintain heating apparatus in both stories, the curtains and the heaters being moved upwards as each successive story is added. To admit hot air to the upper side of the floor slab, temporary 8 x 12-inch circulation holes should be provided through it, one for every 300 feet of floor area. The holes should be somewhat smaller at the bottom than at the top so that when filled with concrete it will thoroughly key itself in position.

The canvas over the top of the structure is generally supported on a light wooden framework made with strips of standard lengths. The top of the framework should be not less than 6 inches and not more than 18 inches above the top of the concrete, thus giving space for air circulation and not requiring too large a volume of air to be heated. The rack or lagging that is placed on top of the framework to support the canvas may be light 1-inch strips 3 or 4 feet long and about 2 feet apart arranged, as indicated in the diagram in panels or sets also about 2 feet apart, thus preventing sagging of the canvas and economizing the support. The lagging is carried on longitudinal and transverse pieces that may rest on the form, or be blocked up from it, or, as is frequently convenient, be supported by clamps bolted to the projecting vertical reinforcement rods imbedded in the wall or column concrete. The details of such an arrangement designed for the protection of a reinforced concrete building, are shown in the accompanying diagram.

HEATING THE ENCLOSED AIR

The air enclosed in the temporary protection for the concrete construction can be maintained at a temperature of 60 to 80 degrees Fahrenheit even in zero weather and colder by the use of stoves or open fires of various kinds in the structures or by steam. If the latter is used it should be supplied to some kind of radiator system or circulated through a sufficient length of closed pipe, although it can, of course, be sprayed through the perforations in the pipes into the enclosed atmosphere thus gaining the advantage of additional moisture there at the expense of a much larger quantity of steam used.

For a large-size operation, such, for instance, as the placing of 500 cubic yards or more of concrete daily, a 50 h. p. boiler maintaining steam at 50 to 60 pounds pressure will be required to heat the air. For smaller operations a 20 to 25 h. p. boiler will suffice, often with a pressure of only 30 or 40 pounds.

From the main steam pipe a 1½-inch branch should be run to within 2 inches of the bottom of the water barrel for the mixer supply. Another 1½-inch branch should be run to coils of 1½-inch pipe under the sand, and a similar one under the stone or gravel pile. The pipes in these coils should be perforated on the under side, or, in case of difficulty through the holes becoming stopped, may advantageously be slotted with a hack saw cutting ⅛ way through the pipe at intervals of 12 to 18 inches.

Another 1½-inch line should be run to the structure and provided with outlets sufficient to command all parts of it and provide steam for the steam coils if such are used, and for melting ice and snow and warming the air in the forms. With low-pressur steam, sections of ordinary garden hose may be attached to these outlets for work on the forms and will be much more convenient and economical and flexible than steam hose or steel pipe.

It is recommended by an experienced contractor that a sufficient amount and pressure of steam should be provided to maintain the aggregate at a temperature of from 35 to 50 degrees when delivered to the concrete mixer, the mixing water at a temperature of 100 to 150 degrees and the concrete itself at a temperature of 60 to 70 degrees when discharged from the mixer, and never at a temperature of less than 50 degrees Fahrenheit.

In order to be sure that the heating is properly attended to, temperature records should be kept

CANVAS PROTECTION FOR UPPER STORIES OF CONCRETE BUILDING—SAND AND GRAVEL PILES IN FOREGROUND HEATED BY STEAM COIL UNDERNEATH

and readings recorded every 4 to 6 hours by thermometers located outside and at several different parts of the work and at different elevations, and the inside thermometers should show a temperature of 60 to 80 degrees under all conditions.

The air surrounding the concrete forms inside the protection may be heated by salamanders instead of steam pipes. These are vertical steel cylinders about 2 feet in diameter and 2 feet high, open at the top and with a grate at the bottom on which coke is burned to heat a large quantity of air in a very simple manner. They should be placed at the rate of about one salamander for every 3,000 cubic feet of air to be heated and should be carefully attended with a small quantity of fuel provided at frequent intervals to secure the greatest economy and efficiency. Care should also be taken to avoid danger of fire from the salamander, and barrels filled with water and fire buckets should be kept ready for immediate service if necessary.

REMOVING PROTECTION AND FORMS

The instructions issued by an experienced firm of contractors to govern the building of large reinforced concrete buildings in cold weather provide that the canvas covering the roof or floor slabs must not be removed until after the concrete is 48 hours old. The sides or walls of the canvas must not be removed until after the concrete is 96 hours old.

If the construction is of the flat slab type, the top canvas must not be removed until after the concrete is 72 hours old, nor the side canvas until it is 120 hours old. The girder forms must not be stripped until the concrete is 122 hours old.

In the construction of a 62 x 63-foot reinforced concrete building for the Erie City Iron Works, steam for heating the aggregate, thawing the forms, and warming the air around them was provided by an 18 h. p. boiler installed close to the mixer and hoisting tower and directly in the rear of the stone and sand piles shown in the accompanying photograph. The aggregates were stored over a gridiron of over 200 linear feet of 1½-inch steam pipe and were covered securely by tarpaulins at night when they were not disturbed by delivery to the mixer. The weather was so cold that it was necessary to enclose the two upper stories of the building with canvas curtains arranged and secured as shown in the picture. With these precautions, the work was carried on in very cold weather and was satisfactorily accomplished at a cost probably not more than 5 or 6 per cent greater than it would have been if the work had been done in warm weather.

George E. Datesman, C.E.

George E. Datesman, civil engineer, who died at his residence in Germantown, Pa., October 18, had been, prior to his resignation last January, for thirty years in the service of the city of Philadelphia, being made Director of Public Works in 1915. He was a graduate of Lafayette College, class of 1883, and first entered the city's service in 1885 as draftsman, afterward withdrawing for a short time for private practice. In 1893 he became principal assistant engineer of the Bureau of Surveys in charge of a large amount of sewer designs, steel piers, dredging and in consultation on subway construction and the elimination of grade crossings In 1913 he was commissioned to represent Philadelphia at the International Building Trade and Scientific Accessories Exposition at Leipzeig, Germany, and to investigate Public Works in European cities. He was also consulting engineer for sewage disposal for the metropolitan sewage commission in New York City.

Charles N. Chadwick

Charles N. Chadwick, commissioner of the Board of Water Supply in the city of New York and chairman of the Brooklyn Committee of Bridges and Tunnels, died at his home in Lyme, Conn., October 23, at the age of 73 years. As a member of the Board of Water Supply he was prominently identified with general administration and legal matters pertaining to the construction of the Catskill aqueduct.

Edwin Thatcher, C.E.

Edwin Thatcher, an eminent bridge engineer, died at his residence in New York City September 21. After graduation from the Rensselaer Polytechnic Institute of Troy in the Class of 1863 he became assistant engineer of a railroad in Iowa and afterwards became one of the pioneer builders of iron and steel highway bridges. Associ ated with Mr. Keepers he for many years conducted the Milwaukee bridge shops, constructing a large amount of work in the West and in the Mississippi valley. Later he was associated for some time with a bridge company in Alabama.

For several years he was chief engineer of the Keystone Bridge Company, Pittsburgh, at that time one of the foremost shops in the country and famous for its construction of the notable Eads bridge across the Mississippi at St. Louis. After leaving the Keystone Bridge Company, Mr. Thatcher personally supervised the construction of concrete bridge work in Cuba and in 1901, in partnership with William Meuser, founded the Concrete Steel Engineering Company of New York, prominent in the promotion of reinforced concrete arch construction.

Mr. Thatcher was a man of high abilities, an able mathematician and an excellent designer. Many years ago he perfected and put on the market the famous Thatcher slide rule, which is of great value for facilitating estimates and computations and for many years was the leading instrument of the kind used in this country. In recent years Mr. Tatcher was engaged principally in consulting practice. He was an able engineer and of an attractive, companionable character that made him hosts of friends. He was one of the last of the old-school engineers prominent in the American Society of Civil Engineers twenty or thirty years ago.

Recent Legal Decisions

COMPETITIVE BIDDING AFFECTED BY TERMS OF BOND

A council passed an ordinance authorizing certain sewer work provided the bidder should give a bond in a sum equal to the contract price "to be forfeited if he failed to complete the work within 90 working days from the execution of the contract." The bond furnished, however, provided that it should not be forfeited, but that only $4 per day should be paid for each working day that the work was not completed after 90 days. This would have been a material consideration to bidders on the contract, and one that might reasonably have affected, favorably to the property owner, the bids of all the competitors. For this reason it was held, Ford v. Excelsior Spring Land & Waters Co., (Mo.) 223 S. W. 960, that there was no competitive bidding and therefore the tax bills for the work were void.

SEWER COMMISSIONER'S DECISION MADE FINAL BY CONTRACT

The Missouri Supreme Court holds, Universal Const. Co. v. City of St. Louis, 223 S. W. 931, that where a city and a contractor agreed that "the sewer commissioner shall in all cases determine the amount or quantity or the classification of the several kinds of work or material which are to be paid for under this agreement, and that he shall decide all questions which may arise relative to the execution of this agreement, and his estimates and decisions shall be final and conclusive," the contract is the law as between the parties and the commissioner is the judge. No appeal lies from his decision in the absence of fraud, mistake, or such gross negligence or arbitrariness as would be tantamount to fraud.

CASH AT CREDIT OF SPECIAL FUND FOR PUBLIC UTILITY DEDUCTED IN FIXING LIMIT OF INDEBTEDNESS

The Alabama Supreme Court helds, Town of Camden v. Fairbanks, Morse & Co., 86 So. 8, that if assets of a city in bonds and money in a sinking fund devoted by law to the payment of specific debts are to be deducted from the total amount of outstanding bonds of that city, for the purpose of determining its actual indebtedness under constitutional provision and limitations, for like reasons cash on hand to the credit of a special fund for a public municipal utility provided by the Constitution must likewise be deducted, in ascertaining a city's indebtedness under constitutional limitation to contract debts in the purchase or construction of such special utility, represented by said special fund in the treasury. In such case it will be presumed that the bonds or cash will be applied to the purpose for which by law it must be devoted.

ORDINANCE PASSED WITHOUT HEARING ON REMONSTRANCES INVALID UNDER NEW JERSEY HOME RULE ACT

The New Jersey "Home Rule Act" of 1917 provides for the filing of a remonstrance by property owners affected by a proposed local public improvement. Such a remonstrance was filed, but was not acted upon by city commissioners, and no hearing was accorded the remonstrants, but an ordinance providing for the construction of sidewalks and curbs upon certain streets was passed without reference to the remonstrances. The New Jersey Court of Errors and Appeals holds, Logan v. Belsferd, 111 Atl. 3. (1) That the ordinance passed under such circumstances was invalid. (2) That the hearing accorded by the statute in such cases was a condition precedent to the valid exercise of the statutory power to pass the ordinance.

REGULATION OF FREE SERVICE OF WATER TO CITIES

The Oregon Supreme Court has denied a rehearing in the case of City of Hillsboro v. Public Service Commission, 187 Pac. 617, 192 Pac. 390, in which it was held that a franchise contract between a city and a water company, whereby the company agreed to install as many fire hydrants as should be ordered by the city, for which the city agreed to pay $1 a month each for five years, after which the company was to maintain and install hydrants without cost to the city, was a rate making contract made by the city not exclusively in its proprietary capacity, so that the Public Service Commission could order the company on its petition to discontinue free hydrants and charge the city $3.50 a month for each hydrant without violating article 1, par. 10, of the United States Constitution prohibiting impairment of the obligations of contracts. The court holds that the provision of section 63 of the Public Service Commission Act that it shall not prevent service to cities free or at reduced rates, does not require free service to cities by public utilities, or deprive the commission of power to control such service; and that the commission can regulate rates charged by a water company supplying water to a city having a home rule charter.

ASSIGNMENT BY CONTRACTOR ON PUBLIC WORKS OF MONEY DUE MUST BE FILED UNDER NEW YORK STATUTE

Before the enactment of the statutes now embodied in sections 15 and 16 of the New York Lien Law, an assignment of moneys due on a building contract took precedence over the statutory liens of those furnishing labor and material. This situation was a hardship to this class, and these sections each provide, the latter in relation to contracts for public improvements and the other for other improvements that no assignment of a contract, or of money, or of part thereof, due or to become due, shall be valid until such assignment be filed in certain specified offices. These sections, it is held, Merchants' Nat. Bank v. Long, 184 N. Y. Supp. 34, were enacted for the protection of a definite class, namely, laborers and materialmen, and cannot be taken advantage of by a judgment or attaching creditor, or by one advancing money to the contractor, where it is not shown that such money was used by the contractor in the prosecution of the work.

NEWS OF THE SOCIETIES

Nov. 30—NATIONAL CONFERENCE OF HEALTH OFFICERS. Dr Henry F. Vaughan, Detroit, Mich.

Nov. 30-Dec. 2—UNION OF MANITOBA MUNICIPALITIES. Annual convention at Brandon, Man. Secretary, Robert Forks, Pipestone, Manitoba, Canada.

Dec. 6-9—INDUSTRIAL SAFETY CONGRESS. State Industrial Commission Syracuse, N. Y.

Dec. 7-10—AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual meeting, New York. Secretary, 29 W. 39th St., New York City.

Dec. 8-10—NATIONAL RIVERS & HARBORS CONGRESS. Annual convention. Washington, D. C.

Dec. 9—THE BROOKLYN ENGINEERS' CLUB. Annual Meeting, election of officers.

Dec. 13-16—AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS. Annual convention. Washington, D. C.

Dec. 16-17—THE KANSAS ENGINEERING SOCIETY. Annual meeting Topeka, Kansas.

Jan. 19—AMERICAN SOCIETY CIVIL ENGINEERS. New York City.

Jan. 19—INTERNATIONAL CUT STONE CONTRACTORS' AND QUARRYMEN'S ASSOCIATION, Inc. Annual meeting. Congress Hotel, Chicago, Ill.

Jan. 25-27, 1921—THE AMERICAN WOOD PRESERVERS ASSOCIATION. Date of meeting to be announced later.

Jan. 25-27—ASSOCIATED GENERAL CONTRACTORS OF AMERICA Annual convention. Washington, D. C.; New Orleans.

Feb. 7—AMERICAN ROAD BUILDERS' ASSOCIATION. Annual convention. Coliseum, Chicago. E. L. Powers, 11 Waverly Place, New York City.

May 17-19 1921—NATIONAL FIREMEN'S ASSOCIATION. Twenty-third annual convention Fort Wayne, Ind.

June 7-9, 1921—NATIONAL FIRE PROTECTION ASSOCIATION. Annual meeting San Francisco, Cal.

June, 1921—CONFERENCE OF MAYORS AND OTHER CITY OFFICIALS, State of N. Y. 12th Annual Conference. Elmira, N. Y.

OKLAHOMA HIGHWAY ENGINEERS

The temporary legislative committee of the Oklahoma Highway engineers has recommended and the highway engineers have adopted the following proposed legislation:

The county engineer shall be appointed by the board of county commissioners. He shall have charge of and be superintendent of all maintenance and construction on the public highways of the county, and of one county only. The minimum salary to be paid in counties with a valuation of ten million dollars or less shall be $2,100 per annum. Where the valuation is from ten to twenty million the salary shall be a minimum of $3,000 per annum; twenty to thirty million $3,600 per annum; thirty to fifty million, $4,200 per annum; fifty million or over, $4,800 per annum.

The law governing the destruction of roads to be made more clear and more stringent. The load per bearing inch and maximum of any wheel to be limited.

All construction work to be performed under the direction of the county engineer to be approved by the state highway department before construction is authorized by the county commissioner.

Salaries of the commissioner of highways, the state engineer and his assistants to be increased to compare with the salaries paid by engineers of other road building states.

NATIONAL MUNICIPAL LEAGUE

Some of the important subjects discussed at the twenty-sixth annual meeting of this society, held in Indianapolis, Ind., November 17-19, were: "Service at Cost for Street Railways, Panacea or Nostrum"; "How the City Manager Plan Works—the Latest Evidence"; "Methods Whereby Civic Organizations Influence Elections"; "Government Aids to Housing."

The Hon. Charles E. Hughes, president of the league, in his presidential address spoke on "The Fate of the Direct Primary."

AMERICAN ASSOCIATION OF ENGINEERS

The following appointments have been made to the New York State Board of Licensing for professional engineers and land surveyors: W. J. Wilgus, 165 Broadway, New York City, appointed for a term of five years; Percy A. Barbour, 29 West 39th street, New York City, appointed for a term of four years; H. G. Reist, General Electric Company, Schenectady, N. Y., appointed for a term of three years; Victor M. Palmer, Eastman Kodak Company, Rochester, N. Y., appointed for a term of two years; E. H. Hooker, Electro-Chemical Company, Niagara Falls, N. Y., appointed for a term of one year.

The New York Chapter of the American Association of Engineers, has voted to contribute a sum not to exceed $100 toward the promotion of the bill providing for a national department of public works.

Under the new regulations just issued railroad professional engineers are designated as "technical engineers. This class shall include civil, mechanical, electrical and other technical engineers inferior in rank to engineers of maintenance of way, chief engineers and division engineers, engineers of maintenance of way and other technical engineers. We are of the opinion that instrument men, rodmen, chainmen, designers, draftsmen, computers, tracers, chemists and others engaged in similar engineering or technical work are not 'officials of carriers.'"

A committee to bring in twelve activities listed in order of importance as desirable lines of activity for the association, was appointed November 10, consisting of Mr. Hodges, J. W. Moore and Mr. Daniels. They will probably ask for suggestions from members at the next meeting.

DENVER MEETING OF THE LEAGUE OF THE SOUTHWEST

At this meeting Director A. P. Davis of the U. S. Reclamation Service told the delegates of his investigations in the Colorado river basin. He said "that the controlling factor on the lower river was the Boulder Canon dam—400 feet or more in height—which would control the floods and furnish power and irrigation for the Imperial valley and other units to be irrigated in the United States and Mexico."

Fred L. Lucas, constructing engineer of Colorado, outlined the plans of the Western States Reclamation Service, composed of thirteen states and announced that a campaign for an appropriation of 250 million dollars for the completion of the various uncompleted reclamation projects was in progress.

FORM NEW ASSOCIATION OF MUNICIPAL CONTRACTORS

At a special meeting held by the paving and sewer contractors of Toronto during the week of October 21 in the Toronto Builders' Exchange, plans were made to form an association consisting of sewer, sidewalk and paving contractors of that city and vicinity and to apply to the Builders' Exchange for permission to operate as a branch of that organization.

A. W. Godson, of the Godson Contracting Co., Ltd., was elected chairman of the new association, and L. C. Reynolds, business manager of the Toronto Builders' Exchange, was elected secretary.

FEDERATED AMERICAN ENGINEERING SOCIETIES

The Kansas Engineering Society has voted to become a charter member of the F. A. E. S. and has appointed Lloyd B. Smith as their delegate to represent the society at the first meeting of the Council. The Alabama Technical Council is also to become a charter member of the society.

The executive board of the Associated General Contractors will meet in the Old Colony Club Rooms at the Raleigh Hotel, Washington, on November 15, 10 a. m.

PERSONALS

Andrews, H. N., has accepted a position in the engineering department of the Wheeling Steel Corporation, Wheeling, W. Va.

Asbury, E. P., has been appointed engineer of Collins county, Texas.

Barrett, Alfred M., formerly superintendent of highways, Borough of Queens, has been appointed Public Service Commissioner for the First District, New York.

Bishop, Hubert K., chief engineer of the Indiana State Highway Department, has resigned.

Boyer, C. C., formerly with the California Highway Department, has been appointed district engineer of the Nevada Highway Department.

Cameron, Major H. F., Corps of Engineers, U. S. A., has been assigned to duty as assistant to the district engineer on the construction of the Wilson dam at Florence, Ala.

Chase, W. G., chief engineer of the Winnipeg aqueduct, has been appointed consulting engineer to the Saskatchewan Water Commission.

Cleveland, L. B., chief engineer and superintendent of the Auburn Water Board, has resigned.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

AUSTIN MODEL 5 EXCAVATOR

The Austin Machinery Co. catalog No. 6 illustrates and describes an excavating machine mounted on caterpillar traction, that with different boom and bucket fittings, can be used as a drag-line excavator, as a steam shovel, as a railroad ditcher, or with a clam shell bucket or a skimmer bucket or as an ordinary locomotive crane or with a magnet hoist.

The principal features of construction include a turntable 5 feet in diameter, hoist drum 12½ inches in diameter, boom suspension control operated by drum geared to main machinery, double cone, spiral control, spring release drum clutches, 12-inch friction disks type inside band, swing clutches and a four cylinder gasoline type machine enclosed, heavy-duty engine with large fly wheels. The turntable and center are made in one piece and multipedal traction is made with special pressed steel units with a combined area reducing the load on the ground to 5¾ pounds per square inch. The machine burns from 35 to 45 gallons of kerosene or distillate in ten hours and has traction speeds of ½ mile and of 1¼ miles per hour, drag-line or hoist line speed of 110 feet per minute, single hitch and swing speed of 3½ r. p. m., giving it a capacity of 300 to 600 cubic yards in ten hours with a ¾-yard bucket.

Used as a drag-line machine with a ½ or ¾-yard bucket and 30-foot boom, the average working speed is 1 to 3 buckets per minute, and the shipping weight is 38,000 pounds. It is recommended for cleaning or enlarging old ditches or building levees, road grading and sewer excavations and for cutting trenches as small as 3-foot bottoms and 1:1 slopes.

Equipped as a steam shovel with a 6½-foot boom and a ¾-yard dipper it is economical for all kinds of steam shovel work and has a long handle dipper arm for the excavation of sewer trenches to a maximum depth of 14 feet. The rated capacity per hour for deep cuts is from 50 to 60 cubic yards and for shallow cuts from 25 to 35 cubic yards. The shipping weight is 35,500 pounds and the average working speed 1 to 3 dippers per minute.

When used as a railroad ditcher it is mounted on trucks with double flange rollers and can be used to advantage on a flat car or between two ballast cars. This equipment weighs 24,500 pounds and is suitable for use as a loading machine when the shovel and dipper arm are eliminated.

When equipped with a 30-foot trussed boom and a clam-shell bucket or an orange peel bucket it is efficiently operated by the two-drum control and is recommended for sewer work, gravel banks, dredging, excavating and general rehandling. It will handle coal, stone, gravel, or sand at the rate of 400 to 600 cubic yards daily, and weighs 32,500 pounds.

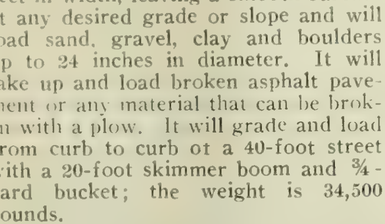
SKIMMER BOOM AND BUCKET EXCAVATING MACHINE WITH CATERPILLER TRACTION, CONVERTIBLE FOR LOCOMOTIVE CRANE SERVICE

When equipped with a skimmer bucket it will make a cut from a few inches to a foot in depth and 12 to 14 feet in width, leaving a smooth surface at any desired grade or slope and will load sand, gravel, clay and boulders up to 24 inches in diameter. It will take up and load broken asphalt pavement or any material that can be broken with a plow. It will grade and load from curb to curb of a 40-foot street with a 20-foot skimmer boom and ¾-yard bucket; the weight is 34,500 pounds.

The 30-foot boom can be equipped with hoisting rackle and bottom block or with a lifting magnet having a hoisting capacity of 4,500 pounds at 30-feet radius, 5,500 pounds at 35 feet, 6,750 at 20 feet and 13,000 pounds at 10 feet radius. It can be mounted either on the multipedal traction, on railroad tracks or on wide traction wheels, and serves excellently as a tractor to pull loaded wagons, trucks and cars.

PIERCE-ARROW MOTOR BUSSES

The Pierce-Arrow Motor Car Company has developed a new type of motor bus which recently was put into active service in Buffalo by the company. This bus, mounted on a Pierce-Arrow two-ton dual valve chassis equipped with pneumatic tires, seats 25 persons comfortably.



25-PASSENGER, ELECTRIC LIGHTED 23-MILE PER HOUR MOTOR BUS

This bus enables the electric railway to give service in newly opened sections without going to the expense of laying tracks. It can be used to relieve the heavy passenger traffic burden during rush hours by running on streets paralleling the trolley streets and thus permitting electric cars to make faster headway.

The steel body is fitted with all safety devices and modern conveniences, including electric lights, push buttons, a heating system and window screens and shades. The bus attains a speed of 23 miles an hour with ease, and handles well in traffic. Although commodious, the bus is of such efficient design that it does not give the impression of bulkiness. It conforms to state and city regulations.

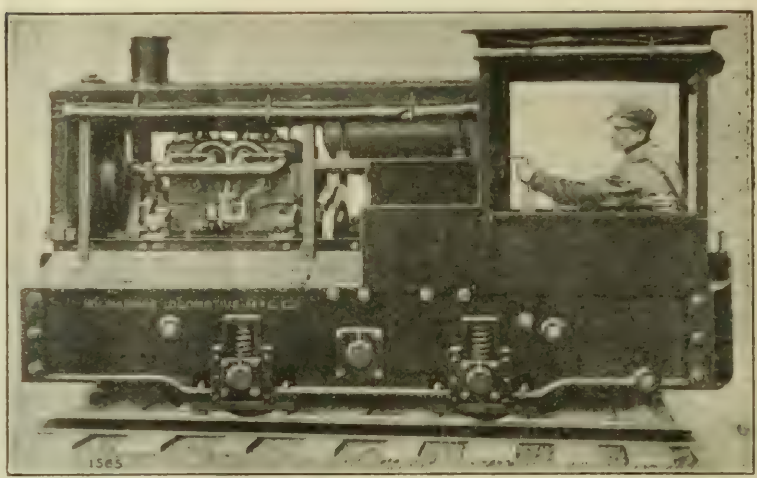
DAKE SWINGING ENGINES

The Dake swinger is a compound gear equipped with Dake reversing engine, making a combination of units powerful in proportion to weight. The operation is very simple, the engine being started, stopped and reversed by the same lever. It gives perfect control of the derrick boom and permits it to be swung at speed and gently stopped in the required position.

There are no reverse clutches and no dead-centers, therefore the engine always responds instantly to forward or reverse motion. The swinger has a low frame and drum that can be bolted directly in front of the main hoist with clearance for the lines, and can be operated from the hoist man's position. It is manufactured with and without the automatic brake, by the Dake Engine Company.

MILWAUKEE GASOLINE LOCOMOTIVES

These machines, made by the Milwaukee Manufacturing Company, are claimed by them to be more economical to install and operate than either electric or compressed air locomotives because they are independent concrete units of power and require no auxiliary power or plant, overhead wiring, bonding of rails, or extensive pipe lines. They are equipped with special four-cylinder, four-cycle, vertical type engine, with oil circulating pump of the geared type. The speeds are changed by means of jaw clutches with all gears in mesh, and the clutch cones of the driving and reversing mechanism may be easily and cheaply replaced. Transmission is of the friction type. For different services, several types are manufactured of 2½ to 14 tons weight. They are made with one and two speeds forward and reverse and can be furnished with electric starting and lighting equipment.



6-TON LOCOMOTIVE WITH ELECTRIC STARTING AND LIGHTING EQUIPMENT

NEW YORK CITY BUYS 50 HOLT CATERPILLAR TRACTORS

As the result of comparative tests made last summer with different kinds of motor vehicles plowing sand spread on asphalt streets to imitate snow, the Department of Street Cleaning, New York City, has ordered from the Holt Manufacturing Company 50 caterpillar 5-ton tractors, artillery model, for the heavy work of snow removal this winter.

These machines were ordered at a higher price than some of the competing machines because it was considered that they were especially fitted for this class of work and on account of the military and commercial records for past performances as well as for the "stability and facilities of the manufacturers."

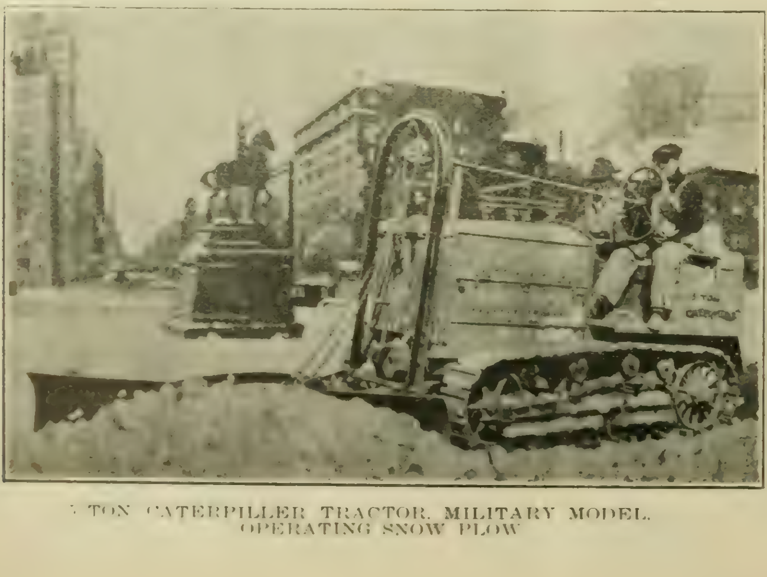
The Holt Company states that "the caterpillar which had been the exclusive tractor choice of all the allied governments during the war, was responsible for the inception of the fighting tanks, and was adapted exclusively by the United States War Department after exhaustive tests, for motorization of field artillery and heavy ordnance transportation." Since the war caterpillar tractors have been extensively used for different classes of commercial and industrial work, including the transportation of materials and machinery in roadless country and for road building and maintenance, heavy hauling, logging and many other classes of difficult work.

HELTZEL STEEL PAVEMENT FORMS USED FOR RECORD CONCRETE PAVEMENT

Heltzel steel forms were used for the highway concreted at record speed by McCrae, Moore & Co., near Big Lake, Minn., as described in Public Works, page 434, November 6.

The operations could not have been so rapid, continuous and satisfactory nor the construction so excellent with inferior forms that might involve delay or cause imperfections.

Other contractors, including Seims, Helmers & Schaffner, of St. Paul, and A. J. Parrish, of Paris, Ill., are reported to have made records concreting with Heltzel heavy-duty type, the standard rail, and Heltzel light road forms with narrow 2-inch top and bottom flanges.



5-TON CATERPILLER TRACTOR, MILITARY MODEL, OPERATING SNOW PLOW

THE H. H. ROBERTSON CO.

The H. H. Robertson Co., Pittsburgh, formerly the Asbestos Protected Metal Co., announces the appointment of Major Hillis F. Hackedorn, former district manager of the Detroit office, as district manager in charge of the following territory:

Ohio (part), Indiana, Arkansas (part), Michigan, Wisconsin, Illinois, Missouri, Iowa, Minnesota, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma (part), Ontario (Essex county).

Major Hackedorn will have his headquarters in Chicago and will have charge of all the company's offices and activities of the company's district managers, agents and sub-agents in the territory enumerated.

PERSONALS

Newcomer, Col. Henry C., has been appointed division engineer of the U. S. Engineering Department with headquarters in New Orleans.

Peters, J. F., has been appointed part-time secretary of the St. Louis Chapter of the American Association of Engineers, with an office at 320 Columbia Bldg., that city.

Rogers, Ira, has been appointed resident engineer on Federal Aid Project 60, Kansas Highway Commission, with headquarters at Garnett.

Sherman, Charles W., of Metcalf & Eddy, Boston, Mass., has been nominated for the presidency of the New England Water Works Association for 1921.

Saunders, W. L., connected with the Concrete Steel Co., New York, has been appointed district engineer of the Washington office.

Simon, Louis I., and Mr. Koenigsberg have opened an architectural and engineering office at 8 South Dearborn street, Chicago.

Thomas, C. C., formerly professor of mechanical engineering, Johns Hopkins University, Baltimore, Md., has opened a consulting engineering office in Los Angeles, Cal.

PUBLIC WORKS.

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Entered as Second Class matter at the Post Office at Floral Park, N. Y., August 27, 1920, under the Act of March 3, 1879

Vol. 49 FLORAL PARK, DECEMBER 4, 1920 No. 23

Ralph Avenue Sewer, Brooklyn

Very large concrete twin storm-water sewer, pump house, sanitary sewer and outlet chamber built in sand below water level. Ample plant installed and careful sequence of operations secured continuous rapid construction. Large amount of ground water handled without difficulty.

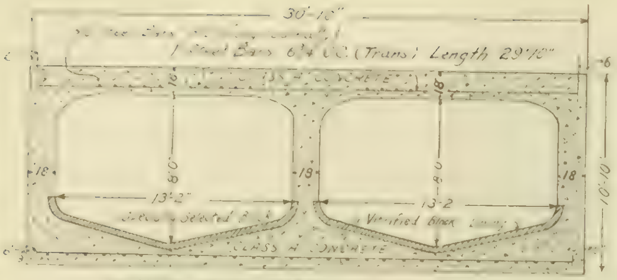
The Ralph avenue sewer, from Remsen avenue to Flatlands avenue, Brooklyn, N. Y., is about 8,350 feet long and its construction, together with that of the pump house, a large outlet chamber, discharge channel to Jamaica bay, sanitary sewer, and various connections and appurtenances, were included in three construction contracts awarded to the J. F. Cogan Company in 1917, and are now approaching completion under the direction of the Bureau of Sewers, Borough of Brooklyn, Arthur J. Griffin, chief engineer.

The principal estimated items of one contract, designated as the middle contract, include 1,635 linear feet of 168-inch storm sewer, 425 feet of 156-inch storm sewer, 2,605 feet of 138-inch storm sewer, 438 feet of 72-inch sanitary sewer, 3,192 feet of 54-inch sanitary sewer, 800,000 linear feet of foundation piling, 200,000 feet of sheeting and bracing, and 300,000 pounds of reinforcement steel. The contract price was $700,238.84, and the time was limited to 400 days, an amount which has been considerably extended on account of delays for which the contractor was not responsible.

Outlet work in Flatlands avenue, including the sub-structure of the pumping station, was let on a separate contract called the third contract, for $432,365. The principal items included in it are 262 linear feet of combined 186-inch, 168-inch and 90-inch storm sewer, 209 feet of 186-inch, 56 feet of 168-inch, 39 feet of 90-inch and 235 feet of 72-inch storm sewer, 156 feet of 54-inch and 156 feet of 48-inch sanitary sewer, 275,000 feet of foundation planking and pile caps, 30,000 feet of piles, 90,000 pounds of steel reinforcement bars, and 60,000 yards of dredging, besides the two connecting chambers, outlet chambers, sub-structure and appurtenances.

STEAM SHOVEL EXCAVATING UPPER PART OF SEWER TRENCH AND DELIVERING SPOIL TO HIGH LEVEL DUMP CAR

The location of the storm sewer was intersected in the middle contract, about half a mile from the pumping station, by the elevated tracks of a branch of the Long Island Railroad, which provided for the advantageous delivery at high level of cement, broken stone and other supplies and equipment, which were received at the yard of the contractor established there. At this point the broken stone was unloaded and stored in large piles on the surface of the ground and the cement was chuted through a hole in the roof of the cement storage house adjacent to the concrete mixing plant. Abundance of clean, sharp sand from the sewer trench excavation was hauled to a storage pile adjacent to the stone storage and was delivered thence by a bucket elevator to the elevated storage bin. The stone was delivered by a

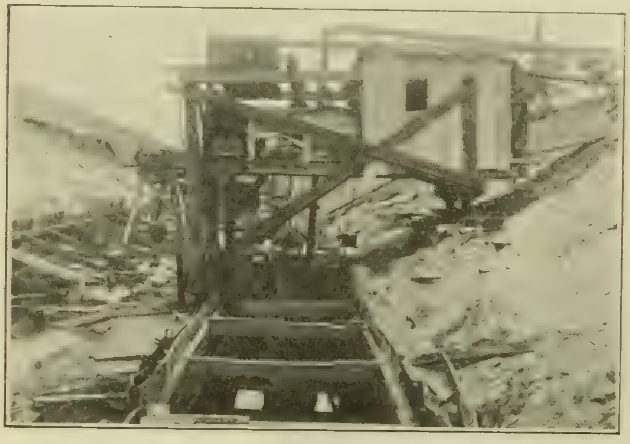


168-INCH TWIN STORM WATER SEWERS

clam-shell bucket operated by a derrick boom to an elevated bin from which, like the sand, it was delivered by gravity to the charging hopper of an elevated 1-yard "Municipal" concrete mixer supplied with cement hoisted to the mixing platform by a barrel elevator.

EXCAVATING AND TIMBERING TRENCH

The twin 168-inch storm sewers are practically one structure divided by an 18-inch longitudinal partition wall and have flat V-shape brick-paved inverts, flat reinforced roof, and 18-inch vertical side walls. Their combined cross section is a rectangle 30 feet 10 inches wide and 10 feet 10 inches high. It was originally designed to build them on a 4-inch plank platform supported on foundation piles, but these were subsequently omitted.



MOVABLE PUMP PLANT DRAINING SANITARY SEWER TRENCH

SECOND POSITION OF TRESTLE FOR CONCRETE SERVICE TRACK INSTALLED ON FINISHED INVERT

The storm sewer in the first contract, and part of that in the middle contract, were built in an open trench about 34 feet wide and with an average depth of about 20 feet below the surface of the ground and 15 feet below ground-water level. As the location is near marshy land on the shores of Jamaica bay and as the soil is coarse, loose sand, a very large amount of ground water was encountered and required expensive and continual heavy pumping, although the operations were so conducted that no delays or serious difficulties were experienced from this source.

In construction the three contracts were handled as one, with the same equipment and with operations arranged for the continuity and efficiency of the work.

The trench was excavated in both directions commencing at the middle of the work, near its intersection with the railroad. The upper part of the excavation, down to sub-grade of the storm sewers, was made with a 1-yard Bucyrus steam shovel, mounted on traction wheels and operating in the bottom of the trench. Where necessary, wooden panels were laid on the sand to prevent the settlement of the shovel and were moved forward by the dipper as the shovel advanced. The sides of the upper part of the trench were sloped to the natural angle but the lower part was sheeted with 2-inch vertical planks 8 feet long, driven about 2 feet below the trench bottom.

The shovel delivered to 3-yard narrow-gauge side-dump cars hauled in two or three-car trains by two gasoline locomotives on a service track on the surface of the ground. Operations were arranged as much as possible for these cars to dump directly into the trench over the finished sewer to provide the back fill without rehandling; but when this was impossible, the cars were hauled to a spoil bank and dumped there.

At the upper end of the sewer in the middle contract, the structure consisted of the twin storm sewers only, but at a point near the location of the concrete plant a line of 54-inch sanitary sewer was constructed adjacent to the storm sewer in a trench excavated at the bottom of the steam shovel trench and sheeted on both sides with wooden sheet piles. This excavation was made with a 1-yard clam-shell bucket operated by the 50-foot boom of a traveling derrick installed on a 15-foot gauge track laid on the surface of the ground coincident with or parallel to the axis of the sewer, the derrick retreating as the excavation was made, and delivering the spoil directly to dump-cars.

The sides of the sanitary sewer trench were sheeted with 2x10-inch wooden sheet piles with the lower ends adzed to a knife edge. The sheeting and its tranverse braces were set as fast as the excavation was made, the clam-shell bucket being carefully handled in the spaces between braces. The sheet piles were driven a few inches at a time by a McKiernan-Terry hammer operated by air from a gasoline engine-driven compressor mounted on wheels and moved along on the surface of the ground as the work advanced. The driving was facilitated by the use of an hydraulic jet in dry ground, and in wet ground by a jet of compressed air which gave equally good results in such ground and was found very convenient.

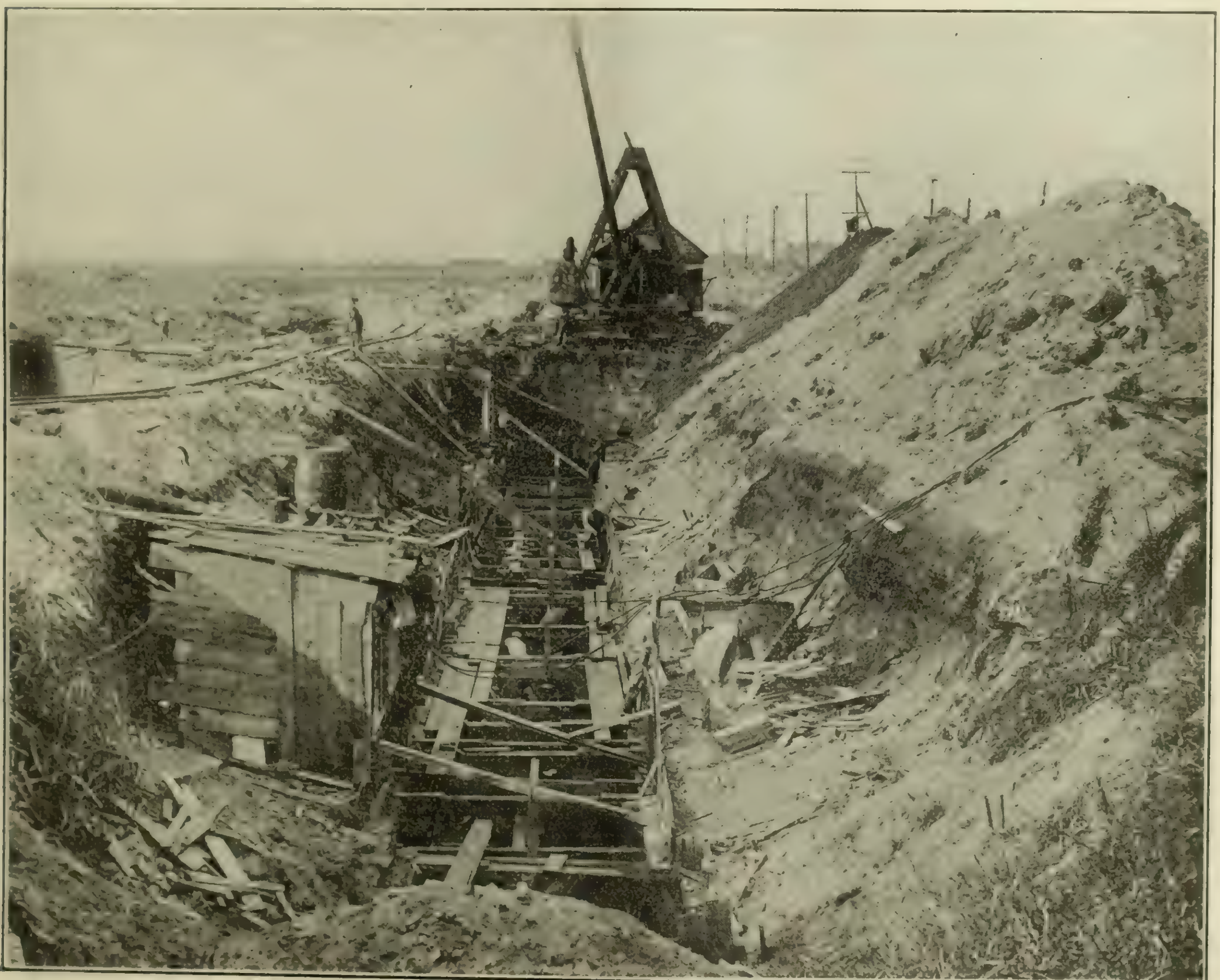
Heavy pumping was required to keep the water down in the sanitary sewer trench, where the bottom was dressed carefully to sub-grade. Piles were omitted, but the entire bottom was covered with two courses of 2-inch longitudinal planks. Notwithstanding that the sand was firm enough to support the sewer without additional foundation, the planks were used to make a floor for the drainage channel and to prevent undercutting by the flowing water.

CONCRETING

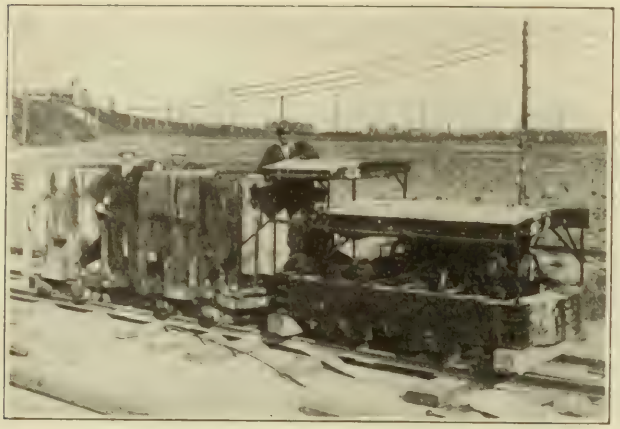
Concrete was delivered in special steel side-dump cars, spouted into the sanitary sewer trench, and filled the whole width of it except a 16-inch space left open along the sheeting on the side away from the storm sewer to provide a channel for the flow of water to the pumps. The concrete was placed first up to the spring-line of the arch, after which the upper surface of the invert was paved with specially selected bricks and the inner and outer forms were set for the concrete arch, which was formed in the same way as the invert and side walls, filling the trench completely except for the drainage channel up to an elevation 12 inches above the spring line, where the vertical outside faces of the side walls intersected the curved extrados of the arch. The sewer was built in 40-foot sections and after the concrete was 48 hours old, the arch forms were collapsed and moved forward for the next section, and so on.

The construction of this low-level sanitary sewer was really the key to the construction of the storm sewers and was pushed forward as rapidly as possible after the storm sewer trench had been excavated to the necessary depth. This sewer contained about ½ yard of concrete to the linear foot, and was built at a maximum rate of 120 feet per week.

In building this sewer, care was taken to leave a clear space of 16 inches between the outer side-wall and the sheet piling, thus providing an open



BUILDING 72-INCH SANITARY SEWER IN LOW LEVEL TRENCH DRAINED BY TWO ELECTRIC PUMPS CONNECTED TO DISCHARGE PIPES ON THE LEFT. HANDLING SAND WITH MOVABLE DERRICK



SIDE DUMP CONCERTE CARS HAULED BY GASOLINE LOCOMOTIVE

channel with the bottom at about sub-grade of the invert, for the flow of the ground water which entered freely through the cracks between the sheet piles. Spaces were intentionally left between the adjacent edges of all the sheet piles on both sides of the trench to permit the unobstructed flow and seepage of the ground water, which was collected in the side channel.

This provided for the thorough drainage of the sand and prevented the collection of water outside the sheeting which would have developed a hydrostatic head that might have caused boiling and upheaval in the bottom of the trench, difficulties that were obviated by this method, which, with ample pumping facilities, not only kept the water down in the trench but gradually drained the adjacent soil so that the upper surface of the ground-water table sloped steeply away from the trench and no difficulty whatever was encountered in keeping the bottom of the trench dry and hard and in holding up the vertical faces adjacent to the sheet piling.

Generally only about 250 feet of the sanitary sewer trench was kept open at each end of the contract and the space was definitely limited every 40 feet by pairs of transverse braced wooden bulkheads 30 inches apart, retaining both the backfill and the face of the earth where the excavation was in progress. The 30-inch spaces between the bulkheads were excavated 30 inches below grade, making sumps in which about a yard of broken stone was deposited, forming a strainer that allowed the considerable flow of ground water collecting around the finished portions of the sewer to pass through to the pump without washing away the backfill.

168-INCH SEWER

After the main trench had been excavated to sub-grade and the low level sanitary sewer built, transverse timber sills were placed on the main sub-grade, and on them framed trestle bents were erected and braced together to form a falsework carrying a service track for the concrete cars that were set to dump on either side into chutes delivering the concrete wherever required.

Transverse wooden frames or ribs with a horizontal upper strip and a lower strip shaped to correspond with the soffit of the invert were set about 6 feet apart longitudinally at the proper elevation. The invert reinforcement rods were usually omitted in the middle and upper sewer contract sections. Panels of wooden lagging were then set under the ribs and nailed to them and the space under them was concreted in 20-foot lengths, core boxes being placed around the lower ends of the trestle posts so as to leave cavities from which they could later be withdrawn. The end of each section of the invert forms was bulkheaded and core boxes attached to the bulkheads to form recesses for bonding with the next section of concrete.

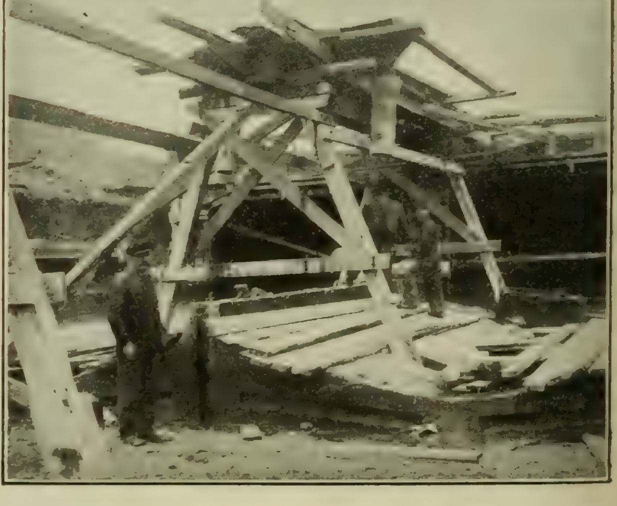
After the invert concrete was 48 hours old, the ribs and lagging were removed and collapsible steel Blaw forms for the side walls and roof slabs were set on the invert concrete, the trestle bents having been removed and the holes left by them in the invert having been filled with concrete.

Reinforcement bars for the sewer roof were laid on the tops of the forms, supported by concrete chairs manufactured at the site by the contractor, and the service track was laid over the top of the forms and extended beyond them on trestle bents replaced on the finished invert so that the cars could deliver concrete both to the roof slab and to the invert in advance.

The roof and side walls were concreted in the same operation, and under favorable conditions with an average total working force of 100 men, the sewer was completed at the rate of about 20 feet per day at each end. The excavating and concreting processes were duplicated and independent at the opposite ends, although both were served from concrete mixed at the central plant.

PUMPING

The trench was drained by four 6-inch, one 8-inch and one 10-inch Lawrence electrically driven centrifugal pumps, most of which were operated continuously day and night. These pumps were installed on movable platforms mounted on special tracks, picked up in the rear and laid down in advance on the bottom of the trench and on the



TRESTLE POSTS FOR CONSTRUCTION TRACK PASSING THROUGH TEMPORARY HOLES IN INVERT sloping sides, so that they could be shifted every few days as the work advanced. The pumps delivered through vertical pipes and short lengths of horizontal steel pipes a short distance above the surface of the ground, which projected beyond the trench and discharged into open wooden flumes that were shifted with them and conducted the water to the nearest gutter or waterway, sometimes at considerable distance and sometimes involving purchase of the right of way for digging the ditch.

After the concrete walls and roof slabs of the storm sewer was 48 hours old, the forms were stripped and advanced, the steel forms being carried forward on collapsible steel towers of the Blaw pattern on trucks mounting on invert tracks. The sheet piles were left permanently in the ground, but the rangers and braces were removed as the concrete was placed, and were used over and over again. The trench was backfilled, the street regraded, and the excess spoil hauled away and wasted, although it was excellent building sand that could have been sold profitably but for the lack of building operations in the vicinity.

PUMP HOUSE

The excavation for the pump house was made by the steam shovel, down to elevation—10, beyond which it was completed with clam-shell buckets operated by the 50-foot booms of two stiff-leg derricks with electrically driven hoisting engines that were installed so as to command the entire site. The pit was drained by the electric pumps and the concrete from the central mixing plant was hauled to place on the service track extended over the surface of the adjacent ground and chuted to position.

The walls were built in 6-foot courses in wooden forms made with panels that were not wholly removed but were unbolted and lifted by the derrick booms for the successive courses while the lower edges of the panels still remained in contact with the faces of the walls that kept them aligned and spaced. The service track was eventually shifted and elevated on a central trestle that passed across the building to give it sufficient height for delivering the concrete by gravity to the upper parts of the walls.

The principal equipment installed on the job included six centrifugal pumps, one steam shovel, two clam-shell excavating buckets, two traveling and three fixed derricks, three Plymouth gasoline locomotives for hauling the concrete cars and the spoil cars, ten Steubner steel side-dump concrete cars of 45 cubic feet capacity, ten 4-yard side-dump wooden cars, one Chicago pneumatic air compressor, two McKiernan-Terry pile driving hammers, one 1-yard "Municipal" concrete mixer and two smaller concrete mixers, 200 linear feet of Blaw-Knox steel collapsible forms, a bucket elevator at the concrete plant for filling the stone and sand bins, and the usual equipment of hand tools.

With the exception of the steam shovel and locomotives, almost all of the plant installed on this job was operated by electricity, thus effecting a large economy of time and fuel.

The construction of both storm water and sanitary sewers in the same trench, with the sanitary sewer excavation and special drainage channel always maintained in advance, was an important feature of the work that both simplified and expedited it and effected an important reduction in the amount of pumping and bracing required in the previously saturated soil. By this method a dry trench was maintained, the bearing strength of the trench bottom was increased, and stability was developed for the sides of the trench.

The total contract price for the three contracts, based on estimated quantities and unit prices, was $1,360,133.59. The principal items for the 8,350 feet of construction on Ralph avenue, between Remsen avenue and Flatlands avenue, include : 262 feet of 186-inch, 168-inch and 90-inch combined storm sewers, 209 feet of 186-inch storm sewer, 1,691 feet of 168-inch storm sewer, 425 feet of 156-inch storm sewer, 2,605 feet of 138-inch storm sewer, 2,018 feet of 132-inch storm sewer, 675 feet of 126-inch combined sewer, 433 feet of 114-inch combined sewer, 39 feet of 90-inch storm sewer, 673 feet of 72-inch sanitary sewer, 3,348 feet of 54-inch sanitary sewer, 156 feet of 48-inch sanitary sewer, 38 feet of 30-inch sanitary sewer, 42 feet of 10-inch sanitary sewer, 60 feet of 8-inch sanitary sewer, 910 feet of flood pipes, 54 manholes, 17 sewer basins, 1 float chamber, 1 connecting chamber A, 1 connecting chamber B, 1 outlet, the sub-structure for pumping station, 1,325,000 feet B. M. foundation planking, 370,000 feet B. M. sheeting and bracing, 133,000 linear feet piles, 365,000 pounds steel bars and 60,000 cubic yards dredging.

Amphibious Steam Shovels

In the construction of 6 miles of the Inland Empire Highway along the banks of the Yakima river, Washington, the contractors, Boss & Hampshire, excavated 180,000 cubic yards of loose volcanic rock and solid lava with two 18-B ⅞-yard Bucyrus revolving shovels mounted on caterpillar traction.

The shovels were shipped by rail to the bank of the river at a point where it is about 300 feet wide and 4 feet in maximum depth, with a gentle current and a bottom consisting of round boulders of all sizes. Steam was got up in the boilers and the shovels crossed under their own power in from 10 to 20 minutes each notwithstanding that some time was lost in removing large boulders and filling holes by the shovel itself. One of the shovels crossed in November and the other about a month later, when considerable ice was running.

Blasting With Quicklime

The National Lime Association describes as follows a very simple, safe and cheap method of wrecking and shattering rocks, foundations, etc., by utilizing the tremendous expansion force developed by slaking quicklime.

"To break up an old stone wall or other masonry, or to knock out a superfluous brick pier without the use of dynamite, slow hand labor is unnecessary. Simply drill a good-sized hole in the wall—making this bottle shaped with as small an opening as possible. Put in quicklime until this hole is almost full and make a tight-fitting wooden plug that can be driven firmly into the opening. Quickly pour in enough water to slake the lime and drive home the plug.

"The expansion of the lime as it slakes will exert a tremendous pressure that will easily break up any ordinary piece of masonry."

Width and Thickness of Illinois Highway Pavements

Evolution of specifications and reasons for increasing thickness discussed by the Division of Highways.

In a bulletin dated October 28, 1920, the Illinois Division of Highways gives the following brief statement concerning the development of pavement widths and thicknesses in that state:

The evolution in highway specifications is, in view of the present traffic situation, an interesting study. In 1913 our plans called for a concrete road 6 inches thick laid on a crowned subgrade. Beginning with 1915 we built a flat subgrade making the pavement 7 inches thick in the center and 6 inches on the side. Conditions brought about by the war forced a heavy truck traffic, especially in the east, and demonstrated the fact that our roads would be called upon to carry a much heavier burden than anticipated. Accordingly, our Federal Aid plans for 1919 called for pavements 7 inches in thickness at the side and 8 inches in the center. We realized later that on our double-track pavements traffic was practically as great on the side of the road as in the center. We therefore decided upon another change and are now building all concrete pavements 8 inches thick throughout their entire width; or where other types are used, what we consider to be the equivalent of an 8-inch concrete pavement.

The evolution in widths has been much the same. In the beginning of state road construction, a 10-foot road was considered sufficient on all roads except those adjacent to large centers of population, like Chicago Now we are building all roads on the Federal Aid System 16 and 18 feet wide. In the future 18 feet will undoubtedly prevail—all of this because of the greatly increased traffic, as evidenced by the greatly increased registration of motor cars and trucks.

During the last session of the Legislature a law was passed limiting loads of motor trucks to 8 tons per axle, including weight of the truck itself. In view of the fact that in most trucks about two-thirds of the weight is on the rear axle this law is generally equivalent to limiting the total load to 12 tons, including truck, or a 5½-ton to 6-ton load, exclusive of truck.

The situation resolves itself into this,—that if we are going to permit truck manufacturers and users of trucks to use any size, or carry any load that may suit their convenience or their fancy we shall have a repetition of the struggle between the weight of the rail and the size of the locomotive, a struggle which has been going on for fifty years and is not yet ended, the difference being that the cost of that struggle was paid by the corporation, while the cost of the same struggle between the highway and truck will be paid by the taxpayers. There is still another difference lying in the fact that in the case of the railroads a change of rails usually settled the matter for the time being, while with the case of the highways, not only the wearing surface will be destroyed but the foundation as well, which means the entire pavement. It is obvious to any reasonable person that this situation cannot be permitted on our highways. We cannot permit a pavement paid for by the public, and which is ample to carry 99 per cent of the traffic, to be totally destroyed by a few unreasonably heavy trucks representing a fraction of 1 per cent of the traffic. The solution lies in arriving at the proper beam strength of pavements to meet the weight of the economic load and then through legislation placing the proper limit on weights of loads, and enforcing the law rigorously.

The Bureau of Public Roads at Washington is making some interesting experiments with a view to determining the relative loads that different types and thicknesses of pavement will carry. The State Division of Highways in connection with the U. S. Bureau of Public Roads is conducting some experiments along a different line for the purpose of determining the actual truck loads that pavements of different types and thicknesses will carry.

Cutting Pavements By Compressed Air

Compressed air has been used to a greater or less extent for a number of years past for cutting through street pavements, as has been described in these columns several times. One of the latest installations for this purpose is that of the Western Union Telegraph Company in San Francisco, which uses an outfit for cutting through the pavements of that city for laying wire conduits and pneumatic tubes. This outfit consists of a 6 x 6-inch compressor with a capacity of 65 cubic feet, operated by a 20 h. p. engine. Air is maintained by this equipment at 85 pounds pressure. The whole is mounted on a two-hourse wagon with a low-hung frame. Long air hose is used so that it is possible to operate with drills at a considerable distance from the compressor.

The Wanaque Dam

Construction begun on the first structure to be built by the North Jersey District Water Supply Commission. An incentive cost-plus form of contract has been adopted.

The Wanaque Dam, construction of which has just been started in the northern part of New Jersey, is interesting from several points of view. The main dam is about 1,200 feet long and has a maximum height from bed rock to spillway of about 155 feet. The engineering design, while not unique, contains many interesting features, as shown in the description of the dam given in the issue of Public Works for April 17, 1920.

The history of legislation and negotiations connected with the work are also interesting, although especially so, of course, to the communities in the northern part of New Jersey. The main feature in this connection, however, is that this marks the first physical result obtained by the North Jersey District Water Supply Commission, which was created a number of years ago with a view to utilizing, to the best advantage of all the communities, all water supplies in the northern part of the state, and to prevent any private or public corporation from so monopolizing the natural water supplies of the district as to make it impossible for any community to obtain an adequate supply for itself. The state law provides for the co-operation of any number of the cities, towns and small communities in the northern part of the state towards the development of a supply for the common use of all.

The commission selected the Wanaque river as offering the most favorable opportunity for serving the immediate needs of several of these communities. Newark, the largest city in the district, immediately decided to go into the project, but so far none of the other communities has definitely committed itself to it, and after negotiations covering two or three years, Newark finally decided to finance the entire project. The law provides that at any future time other communities may join in by paying their proportionate share of the total cost, and it seems probable and in fact almost inevitable that a number of cities and towns will later co-operate with Newark in the expenses and utilization of the Wanaque supply.

The third feature of interest is the form under which the first section of the work has just been let, this being a form of incentive cost-plus contract. Owing to the present condition of the labor and material market and to certain other considerations, the commission decided to limit the contract awarded this fall mainly to the construction of the core wall, which, in any event, would have to be completed before much work could be done on the main part of the dam. This part of the construction is about one-quarter of the total in point of cost. It has recently been let to W. H. Gahagan, Inc., of Brooklyn. Mr. Gahagan had representatives on the ground by November 15, and machinery on the way there, and actual construction of preliminary structures has been begun.

The contract allows the contractor 4 per cent commission on the cost up to a certain base price, while if the cost should fall below this price by $100,000 or less, the contractor will receive in addition 25 per cent of this saving, and if a saving of between $100,000 and $200,000 be made, the contractor will receive 50 per cent of such saving. The base price is fixed tentatively at about $1,125,000, this being the commission's estimate of the cost of the work based on certain estimated quantities and unit prices fixed in connection with assumed labor wage rates. Provision is made for increasing or decreasing this base price in accordance with increases or decreases in prevailing rate of wage, cost of materials, etc. The work was divided into two classes, on one of which the commission fixed a commission of 4 per cent, this consisting chiefly of workmen's quarters, tools, miscellaneous supplies, and other appurtenances of the work which did not form a part of the dam itself, while upon the major part of the work the bidders named the commission for which they would perform the work, and W. H. Gahagan, Inc. named 4 per cent for this part also.

There are numerous minor details regulating the method of calculating the commission due the contractor, but the above gives its broad outlines.

The commission will, of course, have a representative upon the ground to check the timekeeper's accounts and the pay roll, etc. Monthly payments will be made for all materials delivered as well as work done, a percentage of these payments being retained each month until the amount so retained equals $25,000, after which the full amounts of monthly estimates will be paid. The contractor furnishes a bond in a sum equal to 50 per cent of the estimated contract price.

In our description of April 17, a different form of contract was described, which covered the entire work and required the contractor to give a bond for the full amount of the contract price, etc. No contract was let on these terms on account of the high prices caused by several reasons, one of the determining ones being the uncertain condition of both the material and the labor market, another being the difficulty which contractors found in obtaining bond for $4,000,000 or $5,000,000, the estimated cost of the work, consequently the work was subdivided and the method of letting it just described was adopted instead.

The contractor for this first section has been well and favorably known in contract work in this section for twenty years past, and this, combined with the special pains which have been taken to work out the details of the contract just let, leads the commissioners to believe that they will secure satisfactory results with a minimum of cost and a maximum of equity to all concerned.

The work is in charge of Morris R. Sherrerd as consulting engineer and Arthur H. Pratt as acting chief engineer. Charles E. Gregory, who died in February of this year, was deputy engineer. The North Jersey District Water Supply Commission consists of Laurent J. Tonnele as chairman, Ernest C. Hinck, Wood McKee and Obadiah C. Bogardus.

Wood Preserving Notes By Forest Products Laboratory

That charring does not preserve wood and that water solubility is a necessary property of wood preservatives are conclusions by the laboratory from its experiments.

Charring Does Not Preserve Wood—Charring is of little value in protecting the butts of fence posts and telephone poles from decay. This is shown by service tests made by the U. S. Forest Products Laboratory on fences of charred and untreated posts of various species. The charred posts proved in these tests to be even less durable than the untreated ones.

Theoretically, an area of charred wood around a post should prevent decay, because charcoal does not decay or encourage the growth of fungi. But the charred area around a post is not usually a solid covering. It is checked through in many places. If posts are seasoned before they are charred, the charring does not reach to the bottom of the season checks which are always present. If green unchecked posts are charred, checks will open through the charred part as the wood seasons. In either case the uncharred center of the post is exposed to fungus infection and will decay as rapidly as any untreated wood.

Charring deep enough to resist decay would undoubtedly weaken a post of ordinary size.

Water Solubility a Necessary Property of Wood Preservatives—That any substance, to be an effective wood preservative, must be soluble in water at least to the extent of producing a toxic water solution is the basis of a theory now being developed at the U. S. Forest Products Laboratory. It would seem reasonable to expect that any material which is poisonous enough to kill an organism of any kind must necessarily be soluble in the body fluids of that organism; and the chief body fluid of timber-destroying fungi and wood borers is water. With very poisonous materials this solubility need not be great; in fact, 1 part in 1,000,000 may be sufficient if the material is poisonous enough.

Wood preservatives now in use are of two distinct types—inorganic salts, such as zinc chloride, which are very soluble in water; and oils, such as the creosotes, which are generally considered to be insoluble. The solubility of creosote is usually considered so slight as to be neglected, but experiments indicate that certain constituents of creosote are sufficiently soluble in water to make it poisonous for wood destroyers. Creosote oil may, therefore, be considered as consisting of two groups of compounds, one of these being sufficiently soluble in water to render it toxic, the other insoluble in water and hence not toxic. The non-toxic oils act as a reservoir for the toxic oils and feed them slowly to the moisture in the wood.

The difference between oil preservatives and inorganic salt preservatives, as far as this theory is concerned, is in their method of retaining the reserve supply of poison. Zinc chloride has no reserve supply, all the material being soluble in the usual amount of moisture present in air-dry wood. Sodium fluoride may have a reserve supply in the form of solid crystals, if applied in a saturated solution. Creosote oil may have a considerable reserve supply stored in the oil itself, this supply being fed to the wood as needed.

Toledo's Street Railways

At the election on November 2, the voters of Toledo, Ohio, approved the granting of a franchise to the Community Traction Co., a newly incorporated company formed to take over the street railway interests of the Toledo Railways & Light Co. The plan thus approved is to result in a lower fare, the 7-cent cash fare, three tickets for 20 cents and 2-cent transfers being reduced to 6 cents, five tickets for 30 cents and 1-cent transfers. After six months the fare will be determined automatically by the size of the stabilizing fund, on the basis of the net income from the first six months' operation on what is known as a service-at-cost system.

A Board of Street Railway Control, consisting of three members, who are neither interested in the company nor employed by the city, is to be appointed by the mayor, and they in turn will choose a street railway commissioner for protecting the rights of the public, whose salary will be paid by the company. This board of control will also prepare plans for more efficient operation and service, being allowed $1,000,000 for changes and rearrangements in the street railway system.

What may prove to be a valuable supply of road material is being tested on the Warren Nichols farm in Marietta township, near Marshalltown, Ia. The deposit was located last fall by County Engineer H. O. Hickik, and the state highway commission is making borings and tests to ascertain the quantity and quality of the deposit.

The state of South Dakota is expending $100,000 in building a railroad and improving and developing its coal mine. The coal mine will be fully equipped to furnish coal to all the state institutions of South Dakota.

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Why Good Contractors Sometimes Fail to Bid

Important contracts that are apparently attractive sometimes fail to receive enough bids for satisfactory competition, or the bids are excessively high, or sometimes no bids at all are received. When experienced contractors with good records and sufficient resources fail to make reasonable bids for engineering construction work it is likely to be due to one of several reasons that frequently occur and involve risks that on some occasions the contractors decide to take, or to provide for by excessively high bids. These include:

For the last four or five years the great uncertainty of cost of labor and materials and equipment, the poor quality, unreliability and difficulty of obtaining sufficient labor and the difficulties of transportation and manufacture, which, as relating to construction, have been seriously discriminated against by the Federal government.

Poor advertising; the work may not be advertised over a wide enough field or in mediums reaching the proper readers, especially when a large proportion of the advertising is in local papers; it should always be prominently announced in the technical papers devoted to that class of construction.

Insufficient time may be allowed for the preparation of the contractor's estimate and his investigation of conditions, requirements and probabilities, especially for a large or complicated job or one at a distant point.

Very elaborate work, work involving unusual conditions or work in inaccessible or remote places may require so much expenditure for investigation needed to make a safe bid, that conservative contractors will refuse to bid or will bid excessively high prices to insure themselves against unknown contingencies or assumed conditions.

The specifications may be excessively rigid or they may even be conspicuously unfair, sometimes even being deliberately intended to throw all possible risk and responsibility on the contractor and to deprive him of any opportunity to make even a fair profit.

The contractor may be held responsible for conditions and results entirely beyond his control and which cannot be foreseen. Important contracts written by large cities have even specified that the contractor is responsible for damages incurred through the direct execution of the engineers' specific instruction.

The reputation of the engineer, architect or owner may be one of great rigidity and injustice, even of a disposition to injure the contractor or to litigate with him, or to refuse and delay payment to the utmost. He may have a reputation for unfair dealing or unwarranted interpretation of the specifications or classification of work.

The excessive amount of surety demanded or certified check deposited, or the bonding companies may discriminate against a worthy contractor.

The specifications and even the drawings may be so ambiguous or contradictory that it is impossible to be certain of the requirements.

The contract may contain very undesirable elements impairing an otherwise good job. When these elements are only a small part of the total they can be advantageously separated in an independent contract.

The job may be too small or too large and it may be possible to combine several contracts in one or to separate a large contract into several sections, or to classify the work in it and get separate bids on the different classes.

The contractor may be subjected to adverse political pressure or threatened with payment of blackmail or heavy graft to which he will not submit.

The contractor may have open shop policy in a locality where closed shop labor prevails, and therefore be unable to execute work at that particular place which he would do elsewhere. Some important firms are thus excluded from work in certain cities where any business they transact must be through subsidiary or allied firms not opposed by the labor union.

The contractor may be inexperienced or unequipped for the special job, a difficulty that is met by adequate and judicious advertising that offers the work to specialists or contractors of wider experience and located in remote places.

All of these reasons appeal much more strongly to upright and experienced contractors than they do to tricky or inexperienced men, so that the latter often bid on contracts and receive work that they are incompetent or unwilling to carry out properly, thus involving the construction in danger and delay with great risk of poor work and liability of extra cost to the owner. If the contractor is honest but unfortunate he may carry the work through and be ruined by it. His place is likely to be filled by a successor either honest or dishonest, thus discouraging the efficient contractor and eventually costing the city more than if the conditions were improved in the first place.

A Desirable Type of Contract

When a construction job is of a standard, simple nature under well-known conditions, and competed for by several satisfactory bidders, the lump sum form of contract is often a very desirable type. If some one of these conditions is lacking, especially if great uncertainties attend the execution of the job, or if it is of a very prolonged or extremely difficult nature, the lump sum form is likely to work hardship to one or the other or perhaps to both parties.

To meet the difficulties and to expedite the work by allowing its commencement without taking time for long and costly preliminary investigations and estimates, and cost-plus type of contract has been devised and used with varying degrees of success, especially in the emergency work of the late war, and since then, to allow for the great variation and uncertainty in the cost, quality and availability of labor and materials. The principal objections to it have been the possibility of increasing the cost of the work and the contractor's fee by unnecessary construction expenses; a lack of incentive for the contractor to reduce the cost of the work; the possibility of undue prolongation of the work, thereby enabling the contractor to unnecessarily employ his organization and equipment that might otherwise be idle; and the uncertainty regarding charges properly covered by the contractor's fee.

Various modifications have been suggested, and some of them applied, to meet these difficulties and to promote the main object of this form of contract which should usually be to place all the necessary cost of the work and unavoidable risk on the owner; to insure a fair remuneration to the contractor for his skill, experience and the use of his organization, resources, plant and equipment; and to effect a just and reasonable participation by both parties in the economies that may be affected by ingenuity, courage and the efficiency of the construction methods and operations.

One of the most recent and promising examples of this nature is that of the contract recently awarded for preliminary construction work on the great Wanaque dam described in this issue. The work is carefully divided into principal and auxiliary construction, and a fixed percentage is allowed the contractor for the latter and less important part. The contractors were allowed to fix their own percentages in bidding for the main part of the work, which was awarded on a basis of a 4 per cent fee, which happened to coincide with the amount fixed for the other part of the work.

The percentage fee was, however, limited to a certain maximum sum, no matter how great the total cost of the work might prove to be, but on the other hand the fee was increased by a sliding scale bonus increasing with the difference between the actual and the estimated costs of the work if the latter should be reduced beyond certain fixed amounts. Besides these conditions, allowance is made for the increase or decrease of the maximum basis of commission, in proportion to the increase or decrease of fluctuating prices for labor and materials.

These provisions make a very definite basis for the computation of fair and reasonable compensation to the contractor, who finds it to his advantage to execute the work as quickly and economically as is consistent with high-class construction. He is rewarded for efficiency, ingenuity or equipment that may enable him to materially reduce the engineer's estimate of cost, and the owner must in any event pay only for the actual cost of construction and a reasonable fee for superintendence, assuming all the necessary risks, and no more, and thus entirely eliminating the element of speculation.

This arrangement, supplemented by the definite agreement that no doubt exists concerning the amount and character of overhead, superintendence, rental, deterioration, and new equipment charges covered by the percentage or included in the allowed costs, should operate satisfactorily for both parties.

Minnesota's New Highway Commission

At the November election, Minnesota voted in favor of a bond issue of $75,000,000 for good roads, to be spent by a state highway commission which is to be provided for by a law to be passed by the next legislature. It is stated that the commission will probably consist of five persons appointed for a term of not less than three nor more than five years. Preliminary work of drafting the act for carrying out the decision of the voters has already been begun in the offices of the present state highway commission. The law will probably provide for a graduated motor license fee and state motor law standardizing traffic; the license fees to be so graduated that the gross average will not exceed $18 a car.

Reports and Records of Delaware Highways

Forms used by State Highway Department of Delaware in obtaining and recording daily reports from engineers and inspectors on the progress of the work, in preparing monthly estimates, etc. Also daily reports of traffic patrol.

The State Highway Department of Delaware is organized, as described last week, into seven main bureaus, each of which maintains complete records and classified information, prepared from reports that cover the activities of the entire force and showing the history and present conditions of every highway.

The Bureau of Economics and the General Office are conducted in accordance with first-class commercial and technical standards adapted to the specific requirements of the character of the department and local conditions, and need not be here described. As the forms and records that have been developed for the other five bureaus represent efficient engineering for public work, some of the principal features are here presented.

SURVEYS

Surveys of old and new roads, locations, realignments, lines, levels and measurements of cut and fill are made by survey parties, usually consisting of the instrument man, recorder and two assistants, who occupy temporary quarters in the vicinity of important work or are transported back and forth, night and morning, by public conveyance or in default of that, by the department's service automobiles. The leader of the party sends to headquarters a daily report made out on an 8 x 5¼-inch Daily Survey Report blank with printed heads for title, date, weather, temperature, began work, stopped work for A. M. and P. M., chief of party, address, contract, survey, route, between.......... and................, office, field. Separate lines are headed Base Line........... Sta........... Sections or Profile............. Sta.............. to Sta. Check Levels........ Sta.......... to Sta. Names of men in party. Requisitions Issued, and Remarks.

DESIGN

From the surveys and other data the line is located, roadway and structures designed, quantities computed, bills of materials made, contracts and specifications prepared, and invitations issued to bidders. For each contract there is printed an official **Detail Estimate Sheet** 25½ inches wide and 11 inches long, headed Contract No......... from...............to.........Sta.......... to Sta............., Period Ending.........19... Contractors. It is on heavy yellow paper, ruled in 40 main vertical columns with 10 wide horizontal lines below the headings. The first column is headed Station to Station, and the next 29 columns are successively headed: Clearing and Grubbing, Acres; Clearing, Acres; Excavation, Cu. Yds.; Borrow, Cu. Yds.; Rock Excavation, Cu. Yds.; Concrete Masonry "A," Cu. Yds.; Concrete Masonry "B," Cu. Yds.; Concrete Masonry "C," Cu. Yds.; Steel Reinforcement, Pounds; Steel Reinforcement, Sq. Ft.; Pipe, Lin. Ft.; Pipe, Lin. Ft.; Pipe, Lin. Ft.; Pipe, Lin. Ft.; Relaid Pipe, 18 in. and under, Lin. Ft.; Relaid Pipe Over 18 in., Lin. Ft.; Underdrain, Lin. Ft.; Gutter, Sq. Yds.; Concrete Curb, Lin. Ft.; Bounds, No.; Piles, Lin. Ft.; Wood Guard Rail, Lin. Ft.; Concrete Foundation for Roadway, Cu. Yds., Stone for Macadam, Tons; Slag for Macadam, Tons; Cement Concrete Roadway, Cu. Yds.; Joints Do., No.; Vitrified Brick Pavement, Sq. Yds.; Hillside Vitrified Brick Pavement, Sq. Yds. The 10 remaining columns are left blank for any required special headings to be written in.

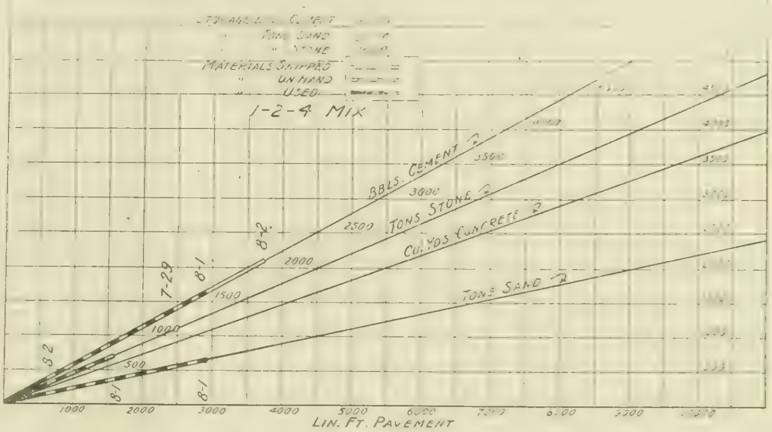


Fig 1. DIAGRAM SHOWING, BY INSPECTION, POSITION OF ROAD MATERIALS

In each main vertical column from 2 to 5 faint vertical lines are ruled to separate the figures. Between each pair of heavy horizontal lines the wide space is divided by four faint horizontal lines, thus allowing for five items for each section. At the foot of the sheet the last three lines are headed, Total to Date, Previous Estimate, and This Estimate.

For the work under contract, state materials are reported on arrival by postal card blanks mailed immediately to headquarters. They are entitled **Daily Report of Materials Received** and are printed thus: "The following shipments of materials have been received for use on Contract No.................1920. Car initials and number. Quantity. Kind and brand of material. Signed....................

In order to secure government freight allowances there was, during the period of Federal control of the railroads, a separate exemption certificate filed for each consignment, a practice that has been discontinued since the return of railroads to their owners.

The amounts of materials shipped, on hand, and used for each contract are marked off on line plotted on a diagram entitled **Material Chart**, which is kept posted up to date and instantly shows by inspection just how the supply stands. The lines here shown for convenience by conventions are, on the office diagram, marked in colors, blue for shipped, yellow for on hand, and red for used.

Each inspector on each contract reports daily on an 8½ x 11-inch blank printed as here shown. The upper part, 6¼ inches long, has, under the headings, 15 lines for records and one line for totals, below which there is a perforated line for detaching the Material and Construction Report 4½ inches long. (See Fig. 2.)

The engineer's report is made on both sides of an 8½ x 11-inch blank. One side is headed: For week ending..............19... .... Contractor...................Resident Engineer, from............ to ....miles.

THE STATE OF DELAWARE

STATE HIGHWAY DEPARTMENT

Inspector's Daily Report

CONTRACT NO.

Temp. Max.
Min.

Weather 192

	Sta.													
LOCATION AND	Sta.													
PROGRESS OF WORK	Sta.													
	Sta.													
COST RECORD					Grading Earth	Grading Rock	Roadside Guard Rail Etc.	Pipe Culverts	Ditches and Drains	Concrete Masonry	Concrete Roadway	Brick Surface		
Classification	No.	Rate	Hrs.	Total										
TOTALS														

DIVISION OF TESTS AND INVESTIGATIONS

Material and Construction Report

Contract No. 192

	ROADWAY	MASONRY
Kind of brick used		
Kind of slag or stone used		
Kind of sand used		
Brand of cement and number of bags used		
Kind and percentage of hydrated lime used		
Source of water supply		
Kind and location of joints		

Kind and condition of material in subgrade

Number and location of cracks in previous day's work

Amount of concrete laid today ft. in cut ft. on fill

From Sta. to Sta. Total Ft.

Number of test specimens made at Sta. and buried at Sta.

Remarks: Signed....................................

Fig. 2. INSPECTOR'S DAILY REPORT

Progress Week Ending............. The space below the heading is ruled for totals on top line, under which there are 14 wide horizontal spaces, each ruled with 3 intermediate lines, making 4 narrow spaces in each set, which are respectively marked at the left, 75 per cent, 50 per cent, 25 per cent, 0. Opposite the printed items, Clearing and Grubbing, Rough Grading, Fine Grading, Concrete Masonry, Concrete Roadway, Concrete Foundation, Vitrified Brick Surface, Surface. Four following lines are left blank for special headings to be written in and are followed by lines headed Completed Highway and Total Contract. On the opposite side of the sheet a table for detail records of work is printed and is followed by 8 lines for the names and titles of engineering force. (See Fig. 3.)

Each member of the engineer field force is required to make a daily report on a blank printed on a postal card. (See Fig. 4.)

Monthly estimates for current payments are made out on 11 x 16½-inch blanks ruled below. (See Fig. 5.) In the column of Contract Items the lines are headed:

Squares Clearing, Squares Grubbing, Squares Stripping.

THE STATE OF DELAWARE
STATE HIGHWAY DEPARTMENT
ESTIMATE

From .... To .... Contract No. .... Estimate No. ....

Sta. .... to Sta. ....
Contractor

Date from .... to ....

Quantities This Estimate	Quantities Previous Estimate	Total Quantities To Date	CONTRACT ITEMS	Contract Prices	Total Amount To Date	Amount Previous Estimate	Amount This Estimate	Remarks
			Total Contract Items					

MATERIALS

	Bbls. Cement			
	Tons Sand			
	Tons Stone			
	Total Materials			

EXTRA WORK

Previous Estimates: Order No.		
This Estimate: Order No.		
Total Extra Work		

Total Estimate to Date		
10 Per Cent Reserved		
Previous Payments		
Total Deductions		
AMOUNT OF THIS ESTIMATE		

Made by ....
Checked by ....
Checked by ....
Audited by ....

This Estimate approved for $......................

.... Date ....
Chief Engineer

.... Date ....
Chairman

Fig. 5. MONTHLY ESTIMATE SHEET

Cu. Yds. Excavation, Cu. Yds. Borrow, Cu. Yds. Screening.

Base Course—Cu. Yds. Cement Concrete Pavement, Sq. Yds. Surface Course.

Tons Waterbound Macadam, Cu. Yds. Cement Concrete Class A, Cu. Yds. Cement Concrete Class B.

Lbs. Steel Reinforcement, Lbs. Plain Structural Steel, Catch Basins, Drop Inlets, Manholes.

Lin. Ft. Inch Pipe Culvert, Lin. Ft. Inch Pipe Culvert, Lin. Ft. Inch Pipe Culvert.

Lin. Ft. Inch Pipe Culvert, Lin. Ft. Relaid Pipe, Lin. Ft. Tile Underdrain.

Sq. Yds. Gutter, Lin. Ft. Curb, Lin. Ft. Wood Guard Rail.

Monuments, Lin. Ft. Piling.

The department maintains a motor cycle traffic police patrol of about one officer to every 10 miles of the most heavily traveled improved roads, the present total number of patrolment being about 20. Each officer reports daily to headquarters on a form printed on a postal card. (See Fig. 6.)

CONTRACT NO.

RESIDENT ENGINEER'S WEEKLY REPORT

For Week Ending .. ..19..

CONTRACTOR'S FORCE	DAILY	WORK DONE DURING WEEK		
Average No. of Men		Clearing	Sta.	to Sta.
Average No. of Teams		Rough Grading	Sta.	to Sta.
Average No. of Trucks		Fine Grading	Sta.	to Sta.
Rollers		Concrete Roadway laid	Sta.	to Sta.
Mixers		Concrete Foundation laid	Sta.	to Sta.
Graders		Vitri. Brick Surface laid	Sta.	to Sta.
Steam Shovels		Surface laid	Sta.	to Sta.
		Pipe laid at	Stas.	
		Culverts under Construction	at Stas.	
		Culverts Completed	at Stas.	
		Bridges under Construction	at Stas.	
		Bridges Completed	Stas.	
		Completed Highway	Sta.	to Sta.

REMARKS:

MEASURING BOXES CHECKED

SCREED (CROWN) CHECKED

Fig. 3. RESIDENT ENGINEER'S WEEKLY REPORT

STATE HIGHWAY DEPARTMENT

EMPLOYEE'S DAILY REPORT

To Be Made Out and Sent to Dover Every Night

Name .... Date .... 192 ..

Address ....

Arrived at work .... Left Work ....

Contract No. ....Sta. .... to Sta. ....

Time away from work .... If absent while work is in progress give length of time and reasons ....

....

Worked today ....

....

....

With (name other employees) ....

Other Information ....

....

Fig. 4. EMPLOYEE'S DAILY REPORT

Station ....
....
....

State Highway Dept.

M. C. Officer's Daily Report

Mileage ....
Gals. Gas .... ..
Qts. Oil ....

Name .... Date 1920

Address ....

Arrived at Work .... Left Work ....

Warned: License Nos. ....

....

Arrests: License Nos. ....

....

Accidents: License Nos. ....

....

Damage to Cars ....

....

Personal Injuries...

Special letter report to be made out of accidents where serious injuries are involved caused by fast and reckless driving

Fig. 6. MOTORCYCLE OFFICER'S DAILY REPORT

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

CATERPILLAR WINCH

The Holt Manufacturing Company has devoted several years to the production of a satisfactory auxiliary winding drum or winch attachment for a tractor. Investigations having convinced them that none of the commercial winch attachments were adequate, the Holt engineers, after several years of endeavor and strenuous field tests, have perfected the winch now placed on the market so that it does not affect the traction ability of the tractor, but increases its operating range.

Power is taken from the transmission plates in the rear and carried to the winch through a gear train and propeller shaft with final miter gears and internal gear type of planetary.

The drum is 8 inches in diameter and 13 inches long with a capacity for 1,300 feet of ½-inch cable or 590 feet of ¾-inch cable. With a pull of 10,400 pounds it has a speed of 108 feet per mintue and reverse speed of 583 feet. With a pull of 4,450 pounds it has a speed of 252 feet or reverse of 1,360 feet. With a pull of 5,840 pounds it has a direct speed of 192 feet and reverse speed of 1,036 feet, and with a pull of 2,485 pounds it has the high speed of 454 feet direct and 2,150 feet reverse. The clutch is of ample size to permit slipping and to secure any speed up to maximum. All moving parts except the winding drum are completely enclosed, insuring protection for the operator. The above specifications apply to the 5-ton Caterpillar tractor, special specifications being provided for the winch on the 10-ton Caterpillar tractor.

Skidding logs out of steep hollows or other inaccessible places is easily accomplished with the winch and then the "Caterpillar" is available to skid the trail down the mountain or pull the loaded wagons to the railroad or mill.

In the oil fields it combines the "caterpillar's" service as a cross-country locomotive, that hauls the boilers, casings and supplies to the location with the ability to pull and run back rods, tubing, etc.

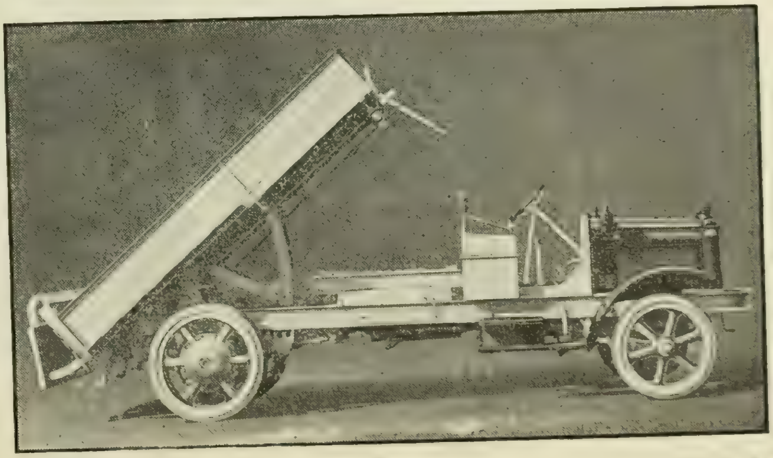
The winch is especially adapted to well-driving service.

TRACTOR WINCH WITH PULL OF 10,400 POUNDS AT SPEED OF 108 FEET PER MINUTE

WHITE POWER DUMPING TRUCK

The Model 45-D 5-ton power dumping truck built by the White Company provides a reliable and durable mechanism for rapidly dumping loose material. Power from the transmission operates a protected screw and nut device controlled by a hand lever at the driver's seat. By this device the truck body can be raised and held at any angle up to 45 degrees, while the truck remains stationary or is driven backwards or forwards. Releases, operating at both ends of the screw shaft, automatically cut off the power when the body reaches an extreme elevation or returns to its normal position.

The dump body is a heavy reinforced steel construction with a swinging tail board, pivoted at the top that can be set for any given discharge, enabling sand, gravel or other materials to be dumped and automatically spread to a uniform required depth while the truck moves forward or back.



POWER DUMP OPERATED FROM DRIVER'S SEAT BY SCREW AND SHAFT PROTECTED MECHANISM

STREET SPRINKLER MOUNTED ON AUTOMOBILE TRUCK

WHITE TRUCK SPRINKLERS

In Oklahoma City and Tulsa, Okla., the streets are flushed by a sprinkler tank mounted on a White automobile truck chassis. When operating on street-car tracks, the dirt is washed out from between the rails by a pair of forward nozzles, after which the jets from the rear nozzles wash it across the street to the gutters.

When there are no tracks in the street, the jets, under 6 pounds pressure, can sprinkle the full width of a wide street and when full pressure is applied, water can be thrown well beyond the curbs on both sides of a 40-foot street.

PERSONALS

McDermott, J. R., has resigned as Assistant Highway Engineer of Harrison county, Ohio, to accept a position with the West Virginia Road Commission as Assistant Division Engineer, with headquarters at Keyser, W. Va.

Wheeler, Frederick S., formerly Resident Engineer of the California State Highway Commission, is now associated with the Efficiency Engineer, Producing Department, Standard Oil Co., Delano, Cal.

Powell, O. N., Dallas, Texas, has been appointed Engineer of Nueces County, Texas, to succeed H. A. Stevens, who recently resigned.

Edwards, John T., has recently been appointed Supervisor of Maintenance in the New Jersey State Highway Department.

Davis, J. C., who was formerly connected with the University of Oklahoma, has been appointed Testing Engineer for the Oklahoma Highway Department.

Snead, Charles D., is now Senior Highway Bridge Engineer, U. S. Bureau of Public Roads, to succeed J. L. Parker, of the Montgomery, Ala., District.

Whitecarver, O. W., who for twenty years was Assistant Engineer of Georgetown, S. C., has been appointed Assistant Engineer with the Charleston, S. C., office of the U. S. Bureau of Public Roads.

Parker, J. L., formerly Senior Highway Engineer in the oMntgomery, Ala., District of the U. S. Bureau of Public Roads, is now Special Bridge Engineer with the South Carolina State Highway Commission.

Allen, James P., and Fitzsimmons, W. S., formerly assistant engineers in the Charleston, S. C., office of the U. S. Bureau of Public Roads, are now engaged in private engineering practice.

Butler, Drury, Surveyor, Sacramento County, Cal., has been appointed County Engineer.

Bennett, M. O., Division Engineer of the Oregon State Highway Department, Pendleton, Ore., has resigned to take up farming at Lewistown, Mont.

Carman, Edwin S., of Cleveland, Ohio, in a mail ballot of the American Society of Mechanical Engineers was elected president of that society, to succeed Major Fred J. Miller.

Winslow, Col. C. Eleleth, who has been Pacific Division Engineer and District Engineer of the First San Francisco District, Corps of Engineers, U. S. A., has been transferred to New York as Corps Area engineer of the Second Corps Area.

Macdonald, K. S., has resigned as town engineer of Barrie, Ont., in order to accept a position with the Hydro-Electric Power Commission at Paris, Ont.

Shaw, A. W., has resigned as water works superintendent of Brandon, Man., after twenty years' service in that department.

Foreman, A. E., of Victoria, B. C., has resigned as chief engineer of the British Columbia Department of Public Works in order to join a business organization in Vancouver.

Thieriault, L. L., has resigned as town manager of Edmundson, N. B., and has resumed his former position as division engineer on the staff of the New Brunswick Department of Public Works, under B. M. Hill, chief engineer of highways.

Hogg, T. H., reputy chief hydraulic engineer of the Hydro-Electric Power Commission of Ontario, and J. J. Traill, assistant hydraulic engineer of the same commission, have been appointed members of the Senate, University of Toronto, to represent the Faculty of Applied Science and Engineering. Dr. George G. Nassmith, consulting engineer, Toronto, has been elected to a similar position to represent University College.

Moore, H. J., who was formerly connected with the Queen Victoria Niagara Park Commission in the capacity of highway forester, is now filling a similar position with the Ontario Highways Department.

Chace, W. G., and Fellowes, Lyon F., have been appointed as consulting engineers to the Saskatchewan Water Commission.

Reaburn, D. L., formerly superintendent of Mount Rainier National Park, has been appointed superintendent of the Grand Canyon National Park.

Nyman, Carl, formerly resident engineer, State Road Commission, Utah, has resigned to enter private practice in general engineering in the coal fields of Carbon County, Utah, with headquarters at Castlegate.

Clements, V. H., has taken a position as assistant engineer in the office of the Irrigation Engineer, Bureau of Public Roads and Rural Engineering, U. S. Department of Agriculture, San Antonio, Texas.

Muth, Frank, Manitowoc, Wis., has resigned as highway commissioner of Manitowoc County to engage in highway and bridge contracting.

Markwart, A. H., a member of the firm of Galloway & Markwart, consulting engineers, San Francisco, has been appointed director of engineering with the Pacific Gas & Electric Co., San Francisco, and will have supervision over the organization's hydraulic, production, transmission and distribution engineers, and also have production, transmission and distribution engineers, and also have charge of designs on all company plants and equipment.

Haasler, John J., formerly office engineer, Nueces County Highway, Texas, has accepted a position as field engineer with the Power Department of San Antonio, Texas.

Johnson, J. G., formerly with the Milwaukee Gas Light Co., and engineering inspector of the Milwaukee Sewerage Commission, has been engaged as city engineer and superintendent of water works, Milwaukee, Wis.

PUBLIC WORKS.

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Entered as Second Class matter at the Post Office at Floral Park, N. Y., August 27, 1920, under the Act of March 3, 1879

Vol. 49 FLORAL PARK, DECEMBER 11, 1920 No. 24

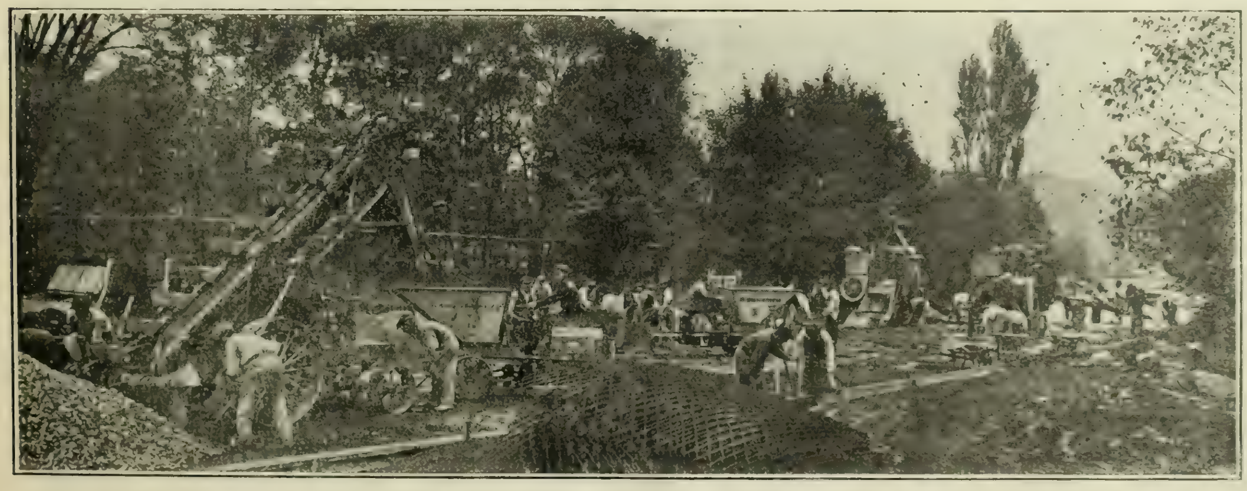
Constructing Asphalt Block Pavement on Bronx Parkway

On this job the contractor is using an unusually complete and up-to-date outfit of labor-saving appliances for all phases of the work, from grading to final laying of blocks.

The Bronx River Parkway Reservation, now in course of construction, extends from Bronx Park, Borough of the Bronx, New York City, to Kensico Dam, Westchester county, N. Y., a distance of about 15½ miles.

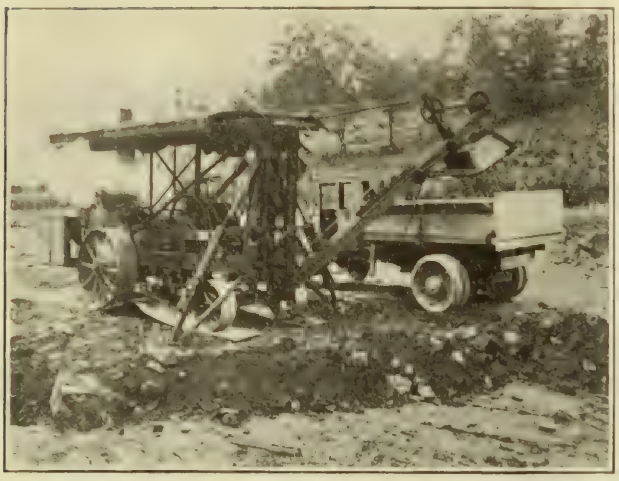
During the past summer a stretch of asphalt block pavement has been laid for the Bronx Parkway Commission by the Hastings Pavement Co., the contract extending from Crane road, Scarsdale, to just inside the southern boundary of White Plains, a total distance of about 13,000 feet, the area of the pavement laid being about 57,000 square yards. The concrete base for this work was completed about the middle of November and the laying of the asphalt blocks was within about a week of completion on the date at which the writer visited the work, November 19; except that at three points breaks were left in the pavement at stream crossings where bridges are now being built and fills of several feet depth will have to be made when they have been completed.

The base throughout is of concrete mixed 1:3:6, 5 inches thick at the sides and 7 inches thick at the center, with a curb 2⅜ inches high where the land slopes away from the road, and 5½ inches high where it slopes up from the road; the former bringing the curb practically flush with the pavement surface and thus permitting the rain water to flow off onto the ground, while the higher curb provides a gutter 3 inches in depth for carrying off the storm water; storm water inlets being provided at intervals of about 300 feet and discharging into the Bronx river, which lies quite close to the roadway throughout most of the work. The surface is of standard asphalt blocks, 2 inches thick, 5 inches wide and 12 inches long, laid on



LAYING CONCRETE BASE FOR ASPHALT BLOCK ON BRONX PARKWAY

Truetractor takes stone from loader at the left, then sand from a loader just beyond the picture at the left, then runs to one of the two mixers seen in the background and dumps directly into loading skip.



KEYSTONE EXCAVATOR GRADING ON BRONX PARKWAY

LOADING STONE BY HAISS LOADER INTO CLARK TRUCTRACTOR

a ½-inch bed of cement mortar mixed very dry. The roadway is 40 feet wide and has a crown of 5 inches on tangents.

The sand for the concrete was obtained about two miles from the work and was loaded into auto trucks by means of a Haiss "Path Digging" wagon loader, which was able to load a five-yard truck in about five minutes. The sand was dumped along the sub-grade in piles at the proper intervals along one side of the road. Stone, which was obtained from the Hudson River Quarries, transported to Hastings-on-Hudson in barges and hauled to the work by motor trucks, was piled along the opposite side of the road about midway between sand piles. A Haiss wagon loader was stationed at the sand pile and another at the stone pile, and these loaded Clark Tructractors from measuring hoppers supported on each loader, which Tructractors carried the aggregate to a concrete mixer about fifty feet away. The empty Tructractor comes down one side of the roadway and receives its charge of sand, then crosses to the other loader and receives its charge of stone, and then returns to the mixer on that side of the roadway. This prevents any interference of the Tructractors with each other. Due to the width of the road, two concrete mixers operating side by side were used and the three Tructractors kept these in continuous operation, carrying a half cubic yard of material in each load. When the work was running smoothly, each Tructractor would de-

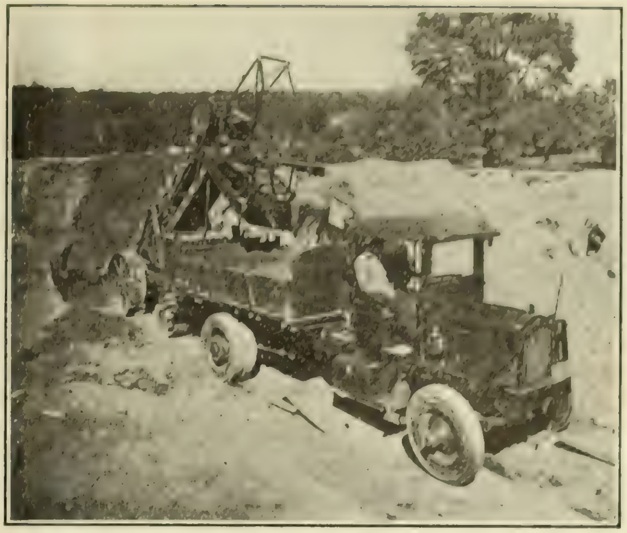
LAYING CONCRETE BASE AND EDGING ON BRONX PARKWAY

Concrete mixers in the foreground; wagon loader and tructractor in background liver a half yard a minute, or about one yard to each mixer for each one and one-third minutes. The Tructractor discharged its load of combined sand and stone into the power loader and at the same time a bag of cement was emptied onto the aggregate and the loader was immediately raised and discharged into the mixing barrel. The two Foote concrete mixers were self-propelled.

The number of laborers required was three for the two loaders, one for each of the three Tructractors, two handling cement, and ten in the gangs of the two mixers, making a total of eighteen laborers on the work.

Water for the concrete was obtained very conveniently from the Bronx river, which at most places was within one hundred feet of the roadway, being pumped through an inch and a half pipe by a small gasoline pump.

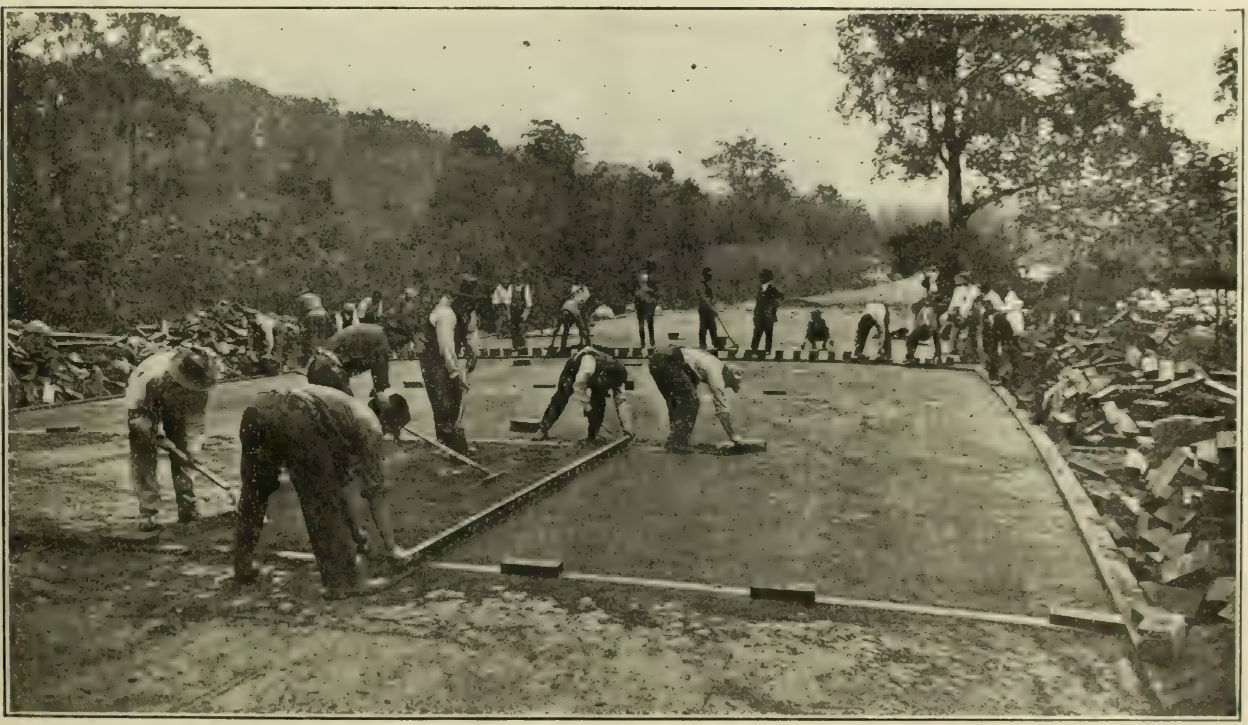
After the concrete had set sufficiently, the asphalt blocks were laid. In this work a gang of from forty to forty-five men was used. The blocks were piled along the side of the roadway and were conveyed to the layers by means of two gravity carriers and eighteen laborers, who supplied the three expert block layers. The blocks were laid on a one-half-inch mortar bed, cement being mixed with the sand in the proportion of one to four, a Foote mixer was used for mixing the sand and cement. The bags of cement were brought to the work in Tructractors, twenty bags to a load, and the sand was brought from the sand bank by motor trucks.



LOADING SAND AT SAND PIT IN WHITE PLAINS

Screen and gravel deflector supported from top of Haiss wagon loader

The sand and cement mixture was spread carefully for the base. At intervals of about fifteen feet thin steel plates four inches wide and ⅛ inch thick were set carefully to the surface desired for the mortar bed by means of ordinates measured from a cord drawn tight across the road. Mortar was spread between these lines of steel plates and a 4-inch steel channel was drawn across the road, the two ends resting on the two lines of steel plates, as a template for surfacing the sand cushion. In the mixing, a small amount of water had been added to the mortar, and after surfacing with the template this was so thoroughly compacted that walking upon it would leave footprints depressed only a small fraction of an inch. Following the surfacing of the mortar bed by the template, the steel bands were removed, the depressions from which they were removed were leveled off, and by means of a small hand template with a shoulder for riding on the top of the



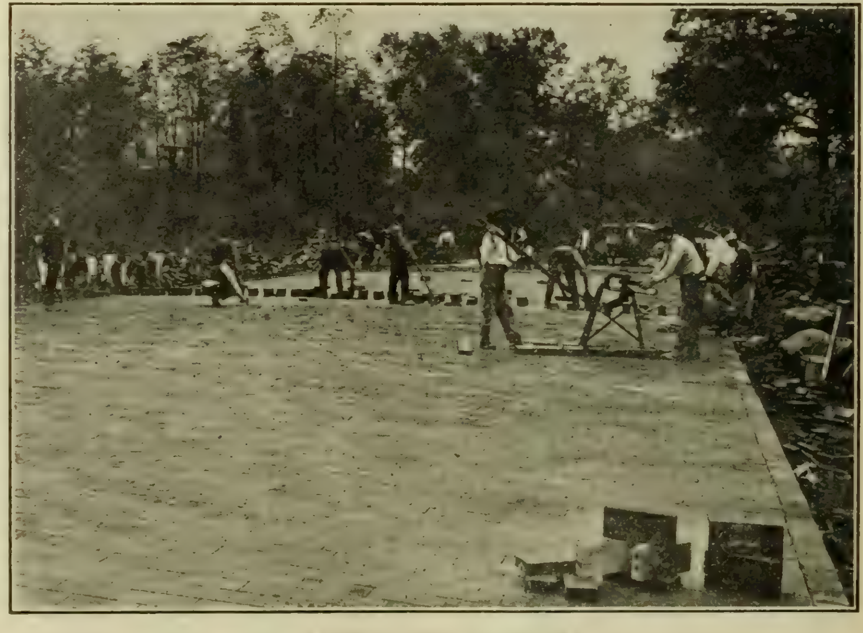
STRIKING OFF THE MORTAR BED AND LAYING BLOCKS.

The steel plates used as a template, the I-beam screed and the gutter screed used for finishing mortar surface at joints are plainly visible.

LAYING ASPHALT BLOCKS ON A 20-FOOT ROADWAY
Blocks delivered by Mathew's gravity carrier

curb, the cushion along the gutter space was carefully graded. Immediately following this, the blocks were laid and a short distance behind this fine sand was spread in a thin layer over the surface and brushed into the joints. At intervals of fifteen feet along the center line of the pavement a row of anchor blocks was laid, each anchor block being provided with a steel band set in the bottom of the block so as to extend about a half inch into the mortar bed. These anchor blocks prevent the "creeping" of the pavement, which formerly gave much trouble with this type of pavement.

The men employed on the laying of the asphalt blocks consisted ordinarily of the following: Three men cleaning the base ahead of the block laying, piling sand, etc.; one with a pick removing protruding stones and other high spots in the base. At the sand-cement mixer, one man handling cement bags, one operating the mixer, three shoveling sand and two with wheelbarrows carrying the material to place; five men leveling off the sand cushion and surfacing it with the template; two men setting the steel bands for surfacing the cushion; eighteen men delivering blocks to three brick layers, and two other layers setting in fillers along curbs, assisted by two men cutting blocks to the necessary length; three men screening, wheeling and spreading sand on top of the blocks. In addition was the driver operating the Tructractor which brought the cement and two on the sand truck. This gives a total of forty-seven men and a foreman. This gang laid about three hundred feet a day of forty-foot roadway. The appliances used on this work consisted of the Foote mixer preparing the sand cushion, two Mathew's gravity conveyors, the Tructractor, the automobile truck and two or three McGowan "transveyors," a small hand truck which was used for carrying packages of cement bags and any other materials too heavy for the hand, but not heavy or bulky enough to require a truck.



LAYING ASPHALT BLOCKS
Machine for cutting closers for courses at right; bottoms of anchor blocks shown in right foreground. Mortar mixer faintly visible in background

Engineering and construction work of Bronx Parkway Commission is under the supervision of Jay Downer, engineer and secretary; L. G. Holleran is deputy chief engineer, and Chester A. Garfield is field assistant engineer in charge of construction contracts.

Leslie B. Farr was general superintendent for the contractor, assisted by Superintendent H. P. Halstead; George W. McIndoe is chief engineer of construction for the contractors, the Hastings Pavement Company.

Force Account Paving in St. Paul

More than two hundred thousand dollars' worth done last year. Fifteen to twenty-five per cent saved over lowest bids.

The Department of Public Works of St. Paul, Minn., does more or less paving work by force account, when it estimates that it can do so at less than the lowest contractor's bid or when no bids are received. In a report dated April 3, 1920, Oscar Claussen, chief engineer of the department, reported that during the previous year five pavements had been laid by force account at a total cost of $200,587. For three of these no bids were received. Of the other two, one cost $70,861, while the lowest bid, plus 2 per cent for cost of city inspection, was $82,571, or 16.52 per cent higher than the actual cost. On the other pavement the actual cost was

$12,662 and the contractors bid plus 2 per cent for inspection was $16,209, a saving of $3,547, or 28 per cent. The figures of actual cost include 3 cents per square yard for brick and creosoted pavements and 10 cents per square yard for asphalt pavements to cover depreciation of equipment, the total amount charged to depreciation being $1,727.

Since 1915 the average price paid for brick pavements has increased from $2.20 per square yard to $5.25, and asphalt pavements have increased from $1.67 to $3.20; the increase from 1919 to 1920 having been from $3.35 to $5.25 and from $2.82 to $3.20, being in each case the greatest increase of any twelve month period.

The city had owned and operated for making asphalt repairs a portable asphalt plant with a capacity of 500 square yards, but during the year this was sold to a paving contractor for $3,000, and all repair work was done with an F. D. Cummer & Son plant which has a daily capacity of 1,100 square yards and it was planned to purchase a new plant of 2,000 square yards capacity. The Cummer plant turned out 59,465 square yards of cut-out work and 5,830 square yards of burner work during the season. Of this 1,619 square yards was for public service corporations, largely repairing cuts of small area, and these were charged $2.25 a square yard up to September 1st when the price was increased to $2.75. Work was also done for the street railway company, which was charged $1.50 for burner work, $1.75 for sheet asphalt cut-out work, and $1.50 for asphaltic concrete cut-out work until September 1st when the charge was increased to $2.25 for sheet asphalt cut-out work. The above charges are based on actual cost of labor and material plus an estimated cost for general supervision, accounting, repairs, depreciation, insurance and interest on the asphalt plant, and was accepted as satisfactory. The cost for the year of plant operation, material and hauling to the street was $97,627.

The total area of asphalt pavements on which repairs were made, that is, the original contract areas on the city's portion of the street, was 353,121 square yards. The area of repairs actually made was 54,944 square yards, or 15.5 per cent of the original contract area. The average cost per square yard of original area was 15 cents. The total area of asphalt pavement on which repairs were made for the street railway company was 47,364 square yards, of which 15 per cent was repaired, at an average cost per square yard of original area of 17.6 cents.

New York-Staten Island Tunnel

New interest is now being taken in the long-proposed plan for a freight tunnel to connect Staten Island with the mainland. The activity during and subsequent to the war of several important shipbuilding plants on the island, the continued growth of the large warehouse and docks established on the east shore of the island, and the construction now far advanced of 12 large municipal piers in the upper bay, increase the necessity for freight communications with the mainland and with New York City and justify special attention now being given to the subject by the Staten Island Chamber of Commerce.

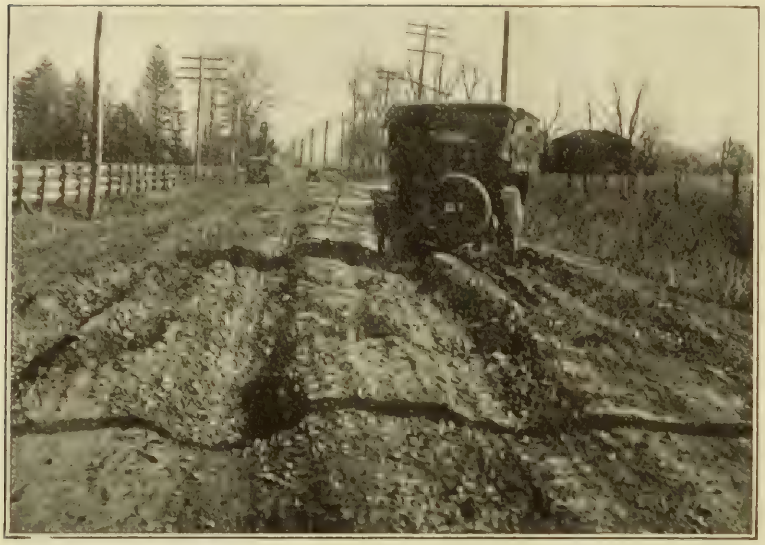
Various plans and locations have been proposed and committees of engineers, real estate men and commercial interests have from time to time been appointed to report on the subject. The last proposition is to discard the lines suggested to Bay Ridge or to Manhattan and to construct a tunnel from the Municipal piers to a point on the Kill where it can make a comparatively narrow submarine crossing to the Jersey shore and connect there with the Pennsylvania, the Central Railroad of New Jersey, the Lehigh Valley, the Reading, the Baltimore & Ohio, and the Lackawanna roads. Special arrangement in harmony with the Connecting Railroad, Hellgate bridge and lines across the Bronx to the Greenville yards and shortened car float ferries will make much more available for New York and the Brooklyn and Jersey warehouses and piers a large amount of business that can be most advantageously handled in Staten Island. The estimates for the new plans have not been made public, but it is known that there are no serious physical obstacles, that the land and river tunnels can be driven readily by advanced methods, and that the right of way and terminals can easily be secured on Staten Island.

280 Mile Road Contract

Work was begun on November 12 on a contract held by Twohy Bros. for the construction of 280 miles of 16-foot concrete road in Maricopa county, Arizona. The contractor expects to build the entire length of road in three years, and complete the entire contract with only eight set-ups of his material plant. This is made possible by the fact that a considerable part of the 280 miles consists of an interconnected gridiron layout of roads lying northwest and southeast of the city of Phoenix.

The contractor is using the most modern methods in every branch of the operation. His equipment represents an investment of nearly one-half million dollars, and includes four Lakewood 14-E gasoline pavers with batch transfers, 18 miles of narrow-gage track with twelve six-ton gasoline locomotives, 216 Lakewood road cars complete with batch boxes and cement compartments, eight double-truck cars, four finishing machines, two bulk cement handling plants, each with a capacity of 900 barrels a day, 800 scarifiers and one clamshell bucket. At present two mixers are operating from one material plant and turning out concrete at the rate of 1,300 lineal feet a day, and it is proposed to lay with these the first forty-one miles of road before the material trestle and cement shed are moved. One mixer is seven miles from the material plant and the other is two miles. A second material plant is to be ready for operation about January 1.

The materials are delivered in bottom-dump railroad cars which are shunted on top of a trestle and dumped directly into bunkers under the trestle, from which the materials are loaded by grav-



ORIGINAL BITUMINOUS MACADAM SURFACE OF PHILADELPHIA PIKE, ON MAIN LINE FROM PHILADELPHIA TO WASHINGTON. FAILURE DUE TO POOR SUB-GRADE AND HEAVY TRAFFIC OF GOVERNMENT CONVOYS

ity into tip-over batch boxes. The sand and gravel are obtained from Tempe, where the contractor has installed a washing and screening plant having a capacity of 1,500 yards a day. Cement is received in bulk and is unloaded by means of a Dracco vacuum plant. From the time it is loaded into the railroad cars none of the concrete material touches the ground until it is placed on the road as concrete.

The Philadelphia Pike

One of the most traveled roads in Delaware is the Philadelphia Pike, which carries a very large and heavy traffic of automobiles and auto trucks between Wilmington and Philadelphia.

At the Wilmington end the grades were steep and the surface poor and in 1918 a contract was let for rebuilding 3.7 miles there with a 19-foot brick pavement on a concrete base with penetration macadam shoulders. The work involved heavy rock excavation and was impeded by traffic, by delay in securing materials, by transportation embargoes by rulings of the United States Highway Council and the Capital Issues Committee, yet it was never completely shut down, and was executed for $92,000 per mile.

The grade was reduced one-half by cutting off the top of Penny Hill by the excavation of 5,000 yards of rock blasted out of a cut 45 feet wide and 12½ feet deep.

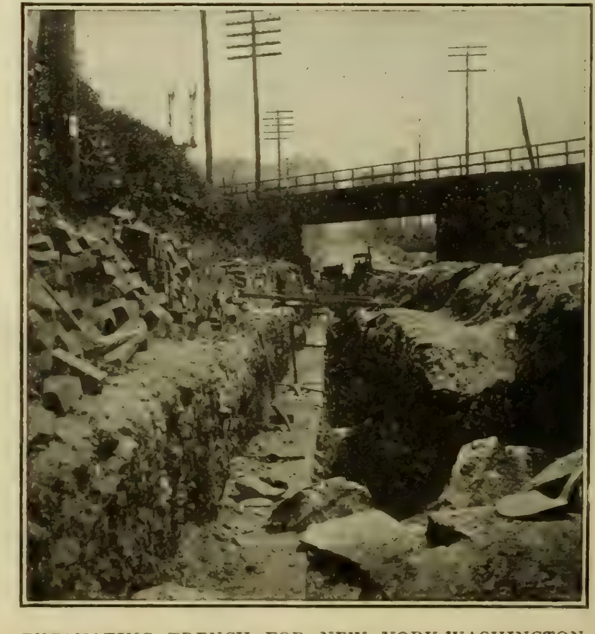
A census of traffic during construction showed from 2,000 to 6,000 motor vehicles per day, averaging 3,000, and increasing 75 per cent in one year.

As the New York-Washington telephone cables, carrying government business, were installed on this road and it was imperative that their service should not be interrupted, impaired or jeopardized in the wartime period, when the road work was in progress, special precautions were observed and the cables were temporarily transferred to poles while a trench was blasted for their permanent installation.

Deepening the Delaware River

The project of deepening the Delaware river from Philadelphia to the sea so as to provide a channel 35 feet deep at mean low water and 800 feet wide is now more than half completed. There still remains to be removed about 24,000,000 yards of dredging and 80,000 yards of rock excavation, in addition to the construction of dykes, bulkheads and other improvements.

FINISHED 18-FOOT VITRIFIED BRICK PAVEMENT ON PHILADELPHIA PIKE, NEAR WILMINGTON



EXCAVATING TRENCH FOR NEW YORK-WASHINGTON TELEPHONE CABLE

Width of Roadways

Review of earlier ideas and conclusions in the light of the increasing sizes and numbers of auto vehicles. Suggested standards for different conditions.

The determination of roadway widths is not a matter susceptible of exact scientific treatment, as several rather indeterminate factors enter into it. The subject has been widely discussed and not much that is new can be added, but a review is warranted, especially because of the development of motor-driven vehicles.

Economy demands that roadways have no greater width than is necessary, in order to save construction costs, while too narrow width may be ultimately uneconomical by compelling later reconstruction in order to meet the demands of traffic. Uneconomical width of roadway may have been caused by the adoption of some arbitrary rule fixing the relation between width of roadway and distance between property lines, or by underestimating the future growth of traffic, or the laying of street railway tracks through streets where they had not been contemplated.

The correction of the difficulties brought about by providing too narrow a roadway involves a reconstruction or widening, generally at very great cost, and hindrance or annoyance to public travel in the meantime. The appearance of the road may be one of the determining factors in deciding upon its width, this including provision for proper width of sidewalks, parking strip or lawn on one or both sides of the sidewalk, etc. This applies principally to parkways, boulevards and certain classes of residence streets where beauty and proportion control the design to a large extent. Even here the expected traffic should receive consideration, but its subordination to other conditions may be perfectly logical and free from criticism.

TELEPHONE CABLE TEMPORARILY CARRIED ON POLES AND MAINTAINED IN UNINTERRUPTED SERVICE CARRYINC WAR DEPARTMENT MESSAGES WHILE ROCK EXCAVATED WAS BLASTED ALONG THE LINE

The financial aspect of roadway widths is apparent. Should the road building programs throughout the country now being advocated progress to the point of construction, it does not seem impossible that for some time to come 10,000 miles of pavement will be constructed annually. An extra foot in roadway width involves an expenditure of from $2,000 to $3,000 a mile for pavement under present conditions. For this country's entire road building project, therefore, a sum of from $20,000,000 to $30,000,000 becomes involved annually in the addition or rejection of a single foot of roadway width. This represents waste if the extra foot in width is unnecessary, but means ultimate economy if the additional foot will be required by traffic.

In addition to the unnecessary cost, unnecessary removal of labor and material from useful application elsewhere is to be regretted.

A too narrow roadway may result in slowing down the speed of traffic, causing accidents due to collisions, or by vehicles being forced off the pavements, and in bringing about a general curtailment of the usefulness of the highway.

The size of the vehicles, the speed with which they are to be driven and the clearance between passing vehicles that must be provided, all are important factors. Passenger vehicles as a class may be assumed to have a maximum over-all width of 6 feet and trucks of 8 feet. There seems to be a natural tendency toward increasing the width of trucks, but so far the maximum of 8 feet seems satisfactory. A rapidly moving passenger vehicle requires greater clearance for safety than a slow vehicle. A provision of 10 feet would seem to allow adequate clearance for all vehicles provided the maximum width of trucks does not exceed 8 feet. This is one or two feet wider than was formerly advocated; but seems warranted by the increase in size of trucks.

This would require a roadway 20 feet wide for two lines of vehicles. Some state roads have been built 14 feet and these are generally found altogether too narrow, while 16-foot and even 18-foot roadway widths are being abandoned for 20-foot by several of the Eastern states.

The length of vehicle has little effect upon the width of tangents, but on curves should be allowed for in providing the additional width at these points. Where long vehicles have to back to the side of the road in order to load or unload, this has a very serious effect on the width. Many trucks are 25 feet long and have become a determining factor if their use necessitates backing up to the curb or to the side of the traveled roadway.

Ten feet would seem to be ample width for a roadway restricted to one line of vehicles, a case which seldom occurs. On light-traffic roads where utmost economy must be practiced, the minimum width must generally provide for two lines of vehicles and should be 20 feet, although this may be reduced to 16 feet where the shoulders are so constructed that vehicles can safely pass each other. Ten feet width for each line of vehicles is recommended as applying to all moving vehicles, including street railway cars, with 7½ feet for vehicles parked along and parallel with the side of the road. If these figures be assumed as fixed, the problem of establishing roadway width is one of determining the number of lines of moving and standing vehicles.

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*Abstract of Paper before the American Society for Municipal Improvements, by Robert Hoffmann, commissioner and chief engineer, Cleveland, Ohio.

In making such determination, the growth of traffic must be considered but must be determined by judgment as no exact data can be obtained. It is well known that the improving of a road by proper alignment, easy grades and a smooth surface invites traffic, bringing to such road a far greater number of vehicles than had previously driven over it, and also usually new buildings which in turn bring added traffic in both trucks and passenger vehicles. It is also a matter of nice judgment to determine where allowance should be made for vehicles stopping along the side of the roadway.

The author offers the following classification as a suggestion of roadway width in accordance with the foregoing ideas:

(A) City Streets Having Double Street Car Tracks

1. Roadway 75 or 80 feet in width. A roadway of such width will accommodate on each half one line of street cars, two lines of moving traffic and one line of standing vehicles; or one line of street cars and three lines of moving traffic. In the latter case the 80-foot width is preferable. The distance between property lines should be from 106 to 120 feet.

2. Roadway 55 or 60 feet in width. A roadway of such width will accommodate on each half, one line of street cars, one line of moving traffic and one line of standing vehicles, or one line of street cars and two lines of moving traffic. In the latter case the 60-foot width is preferable. The distance between property lines should be from 80 to 100 feet.

3. Roadway 40 feet in width. A roadwav of such width will accommodate on each half one line of street cars and one line of either moving traffic or standing vehicles. The distance between property lines should be at least 60 feet.

(B) City Streets Having No Street Car Tracks

1. Roadway 40, 55 or 60 feet in width. Same condition as for streets having street car tracks, except that line of street cars is replaced by line of moving vehicles. Absence of street car tracks will frequently permit traffic going in one direction to occupy more than half the roadway. This would be possible when traffic is periodically greater in one direction than the other.

2. Roadway 20 to 35 feet in width.—Residence streets. A roadway of such width will accommodate two to four lines of traffic under different combinations of moving and standing vehicles. The distance between property lines should be 40 to 60 feet.

(C) Highways Outside of Cities

1. Roadway 40 or 55 feet in width. For traffic between important centers of population. A roadway of such width will accommodate four to six lines of traffic under different combinations of moving and standing vehicles.

2. Roadway 30 to 40 feet in width. For traffic between centers of population of less importance than the foregoing. A roadway of such width will accommodate three or four lines of traffic under different combinations of moving and standing vehicles.

3. Roadway 20 to 30 feet in width. For traffic between cities and smaller places or between important smaller cities. A roadway of such width will accommodate two or three lines of traffic under different combinations of moving and standing vehicles.

4. Roadway 16 to 20 feet in width.—Rural highways. A roadway of such width will accommodate two lines of traffic.

5. Roadways 8 to 10 feet in width. Light country traffic where earth at side can be used to a limited extent.

(D) Streets In Small Towns and Villages

1. Same classification as in cities, except that additional width may be required for standing vehicles where business is concentrated on few streets, so as to permit parking perpendicular or at an angle to the curb. Twenty to twenty-five feet for each row of standing vehicles will be desirable in this case.

It must also be decided what streets, if any, are to be used for the parking or storage of cars. It may be necessary to so design roadway widths that the greatest number of cars may be accommodated within a limited district, which may require provision for cars standing at an angle with the curb.

A Watertight Sewer

Unusually good construction has been secured in building on Ralph avenue, Brooklyn, about 3,000 feet of 54-inch circular concrete sanitary sewer at a maximum depth of 10 feet or more below ground-water level in sandy soil.

Immediately after completion the amount of leakage in the whole length of sewer was measured and found to be only 14 quarts in 40 seconds, not nearly enough to provide full flow through a ½-inch pipe. No waterproofing solutions or fabric were used on the sewer, which was a part of the regular contract by the J. F. Cogan Company, who built at the same time the large adjacent twin storm-water sewer under the direction of Arthur J. Griffin, chief engineer, Bureau of Sewers, Borough of Brooklyn.

The invert is paved, up to the spring line, with selected bricks, the upper course of which, on each side, was omitted and when the arch was concreted this space was filled with cement mortar, also covering the top of the side wall and making a special skewback bed for the fresh concrete. Although large quantities of ground water were encountered, by means of a special drainage channel the invert concrete was kept dry until well set. The concrete was mixed with great care, and was wet enough to flow to place without shoveling. It was 1:2:4 mix, without lime and was made chiefly with ¾-inch stone, none being larger than 1½-inch. When the concrete was found to lack usual plasticity an extra bag of cement per batch was added with good results. It was not rammed or rodded but was puddled with hoes occasionally. The work was executed under the immediate supervision of Assistant Engineer I. H. Kirby.

Open Shop Makes Heavy Gains

From data received in a nation-wide survey made by the Iron Trade Review, it is announced that 1,665 chambers of commerce and 540 other organizations in 247 cities located in 44 states have undertaken a campaign for the promotion of open shop which in some cases takes the form of public demonstrations to secure the pledges of all employers to the open-shop policy. Among the organizations pledged are 23 national trade and industrial associations.

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Convention Attendance by City Employees

Practically every branch of municipal work which requires specialized information for its proper conduct is served by an organization such as the water works associations, American Society for Municipal Improvements, firemen's associations, highway associations, Association of Municipal Electricians, etc. Ought municipalities to pay the expenses of its employees who attend these conventions? In the majority of cases, we believe, the expenses are so paid, presumably on the basis that the information and inspiration obtained at these conventions will result in an increased efficiency which will more than compensate for the money spent.

In the 1919-1920 report of Edward E. Wall, water commissioner of St. Louis, he states that these privileges should be granted and the expenses paid by the city of having its representatives at these conventions "where the advertising value is apparent and where the city reaps the benefit in the increased value of the services of technical men whose ideas have been broadened and whose knowledge has been increased through association and acquaintance with the brightest minds in the country, who gather together for the purpose of exchanging ideas at these national meetings. To allow the city of St. Louis to go unrepresented at such annual conventions as those of the American Water Works Association, American Public Health Association, American Society of Civil Engineers, and the Amercan Society of Mechanical Engineers, in all of which organizations the St. Louis Water Works has been well and favorably known for years, and to whose proceedings and publications employees of the water division have been frequent and valued contributors—to allow the active participation of the city of St. Louis in all these societies to lapse would be a grave mistake and would entail the loss of prestige in national technical circles that might never be regained. The amount of money annually spent by the city for representation at these meetings is insignificant when the great and lasting benefit of such national advertising is considered."

In all branches of human activity progress is being made so rapidly that anyone getting out of touch with it for only a few years will find himself sadly behind the times. And nothing is more certain to give a man a definite idea of recent progress and broaden his vision than attendance at these conventions, and the city whose officials and higher employees are not encouraged to take advantage of such opportunities is bound to suffer in the efficiency of the services rendered it.

Municipal Bonds in Demand

The demand for municipal bonds during November resulted in more favorable terms being obtained by states, counties, cities and towns, which disposed of nearly $50,000,000 worth of bonds during the month, according to the Daily Bond Buyer of New York.

The generally unsettled condition of business, the slump in stocks and commodities, and the sharp decline in money rates were the principal factors in increasing the attractiveness to purchasers of high-grade bonds. Bonds of the larger cities which for several months have been offered at prices yielding over 5 per cent are now selling on an income basis of 4½ to 5 per cent, with the demand greatly exceeding the supply. Indications are that municipal bonds will increase rather than decrease in value during the next two or three months.

The Uselessness of Excessive Wages

In a recent steam shovel job in New York City the shovel runner was able to demand and received a wage of $164 per week, including overtime. As this was more money than he was capable of intelligently or usefully expending, he proceeded regularly every Saturday night to purchase a costly silk shirt which he wore the following day and on Monday cut off the sleeves and used it for a working garment during the week.

Without experience, responsibility or efficiency justifying a half even of the enormous wages which he received, he was incapable of making a proper use of them and they simply afforded him opportunity for conspicuous extravagance even if he avoided vicious use of the money. It might be supposed that, realizing the profitable nature of steam shovel work, he would have saved his earnings with the ambition of purchasing a steam shovel and thereby establishing himself in a safe and lucrative business; but such does not seem to be the case and this instance only illustrates the universal truth that any large excess of wage paid over what is actually earned and the man is accustomed to receiving generally results in serious injury to him and to the public, not only in encouraging vice and extravagance but in giving an opportunity for idleness and almost inevitably causing dissatisfaction, restlessness and unreliability; there remaining no justifiable reason for paying a man money that he cannot properly spend.

Highway Funds For 1921

Figures at hand indicate that there will be available next year for highway purposes, federal, state and county founds totaling $1,500,000,000. It is not anticipated that this sum or anything like it will be spent in 1921, but the amount will be available and as much of it can be spent as conditions will permit the use of to advantage.

In November the voters approved the issuing of $60,000,000 worth of bonds by Missouri, $75,000,000 by Minnesota, $50,000,000 by West Virginia, $5,000,000 by Colorado and $2,000,000 by Idaho. In Virginia an act was approved by the voters permitting the legislature to fix the amount of a highway bond issue not to exceed $50,000,000. In Kansas an amendment to the constitution was adopted permitting the state to pay one-fourth of the cost of road construction, such cost not to exceed $10,000 a mile or more than 100 miles in any county. California had previously authorized the issue of $40,000,000 of highway bonds at 4½ per cent, but the bonds could not be sold at that rate of interest this year, and at the recent election the voters approved the proposal to permit the rate to be raised sufficiently to sell the bonds, with a limit of 6 per cent. New Jersey voted $29.000,000 in bonds to pay that state's share of the cost of the vehicular tunnel beneath the Hudson river.

In four states proposed highway bond issues were defeated. A $20,000,000 bond issue in Florida and $30,000,000 bond issue in Washington were defeated because it was the intention to use motor vehicle registration money to float ,the bond issues, and this was opposed. Montana rejected a $15,000,000 bond issue and New Mexico a $2,000,000 bond issue, the latter presumably because it had been opposed by officials as unnecessary.

During 1919 California voted $40.000,000, as already stated, Oregon voted $12,500,000, Nevada $1,000,000, South Dakota 4,500,000 Wyoming $2,800,000, Maine $10,000,000, Michigan $50,000,000, and Utah $4,000,000. Comparatively little of this total of $124,800,000 voted in 1919 has yet been spent.

In 1920, in addition to the sums voted at the November elections as stated above, Alabama authorized $25,000,000, Oregon $10,000,000, and Maryland $3,000,000.

In addition to the state funds, there will be about $160,000,000 of the federal aid road funds which is still available. More than $350,000,000 was provided this year by counties of 32 of the states where the county is the principal unit of road building. The amounts appropriated this year by the various counties are shown in the accompanying table. Perhaps some of this has already been spent, but on the other hand there have probably been other sums provided for by bond issues or other methods of raising funds which have been omitted in the tabulations.

Alabama	$5,000,000
Arizona	8,400,000
Arkansas	2,400,000
California	24,635,000
Florida	1,515,000
Georgia	15,245,000
Indiana	7,373,000
Illinois	8,862,845
Iowa	18,475,000
Kansas	50,000
Kentucky	1,700,000
Louisiana	5,850,000
Michigan	2,300,000
Minnesota	12,800,000
Mississippi	15,773,000
Missouri	13,504,000
Montana	6,283,000
Nebraska	3,000,000
Nevada	1,200,000
New Mexico	200,000
North Carolina	13,609,000
Oklahoma	1,158,000
Oregon	9,696,704
Pennsylvania	21,337,553
Rhode Island	8,500,000
Tennessee	7,185,000
Texas	86,023,000
Vermont	2,766,000
Washington	8,225,000
West Virginia	7,039,200
Wisconsin	36,525,000
Wyoming	2,800,000

The above figures total to something over $1,000,000,000. In addition to them there are large sums of money previously appropriated and still available to be spent by a number of the states prior to 1919, such as the $60,000,000 voted by Illinois and $50,000,000 by Pennsylvania in 1918, the amounts to be spent by Massachusetts, New York and other states with large highway construction programs. Also most of the larger cities have extensive paving programs for next year made necessary by the postponement of desirable work during the past year or two of high prices. An estimate based on figures at hand gives the total of these sums available for expenditure at half a billion dollars, which will be spent as soon and as quickly as conditions will permit the construction to be carried on.

Sub-Surface Sewage Disposal

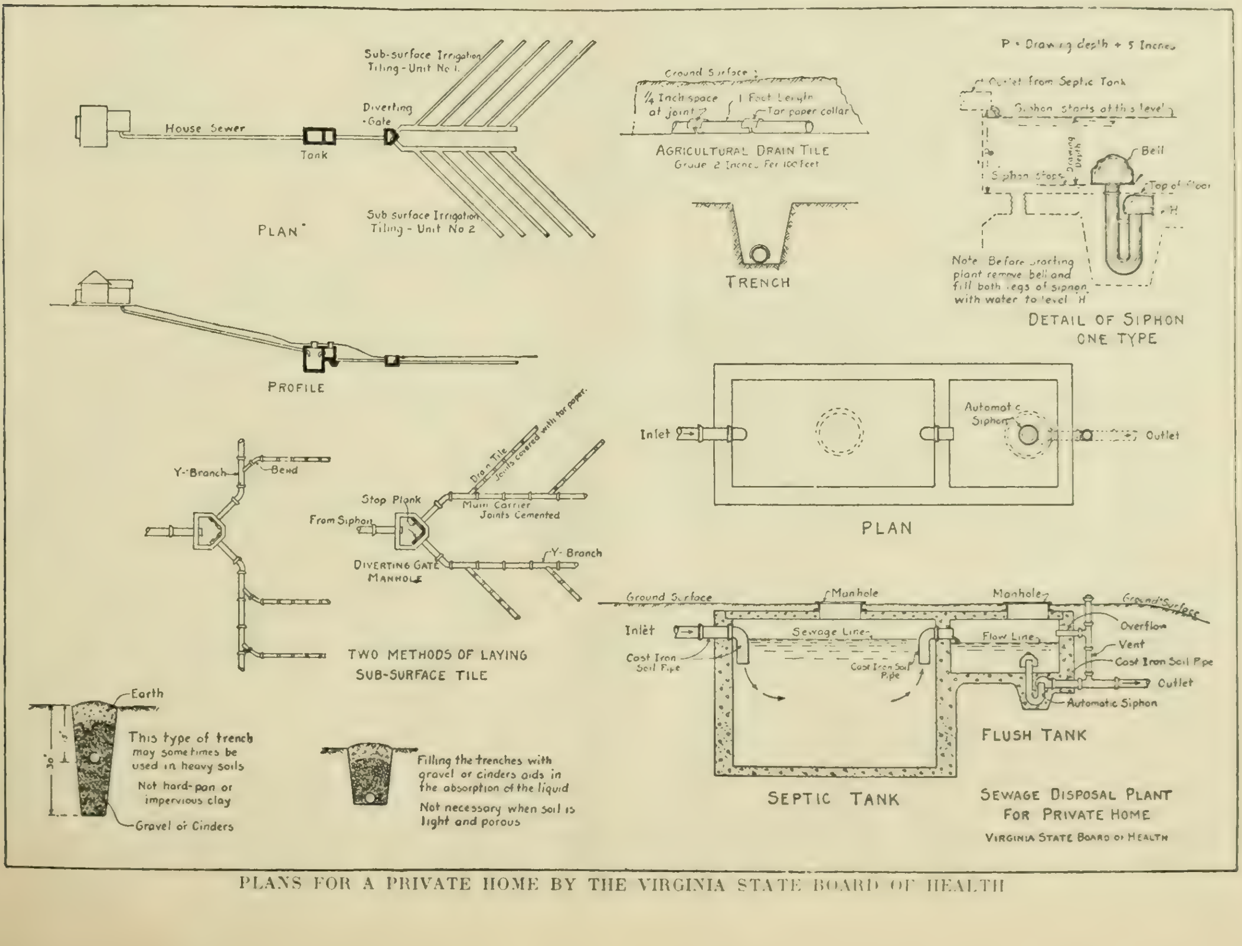
By W. A. Hardenbergh

The author has compiled and compared the recommendations of a number of state boards of health and other authorities on the structural details of sub-surface plants as well as area and kind of soil necessary to secure satisfactory results.

In the ordinary small home sewage treatment plant and in many school and institutional plants as well—it is impossible to expect that very much supervision, care or maintenance will be given after installation. The septic tank works very well under these conditions, better, perhaps, than might be expected; but the final disposal of the effluent is a considerable problem. Sub-surface irrigation is usually the solution for those cases where contact beds, sprinkling filters, or sand beds cannot be used on account of the neglect that is almost certain to be their share after they have been turned over to the owners.

Properly installed, sub-surface drains give considerable satisfaction. Improperly installed, a corresponding amount of trouble and nuisance may be anticipated. Very many local, and other, considerations are important in determining what is proper or improper installation. No case can be judged beforehand, but to give a general review of the field, recommendations of various state boards of health and other authorities are given herewith.

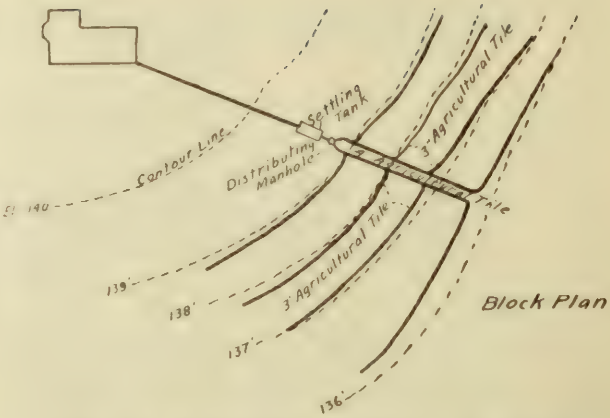
Louisiana, in the Quarterly Bulletin of the State Board of Health for May. 1913 (the latest available) gives the following recommendations: The distribution of the sewage through the soil is best effected by lines of tile drains laid with uncemented joints about 12 to 18 inches below the surface of the ground. The lines need not be straight, but should follow the contours of the ground, with a fall of 2 or 3 inches per hundred feet. The area required for this treatment depends, of course, on the nature of the soil, and may be determined by allowing one-half foot of pipe per gallon of flow per day in sandy soil, and one foot in fairly dense loam. In dense or clayey soils the absorptive power may be increased by excavating trenches two feet wide and a couple of feet below proposed grade and


Sub-surface Irrigation Tiling - Unit No 1.
House Sewer
Tank
Diverting Gate
Sub surface Irrigation Tiling - Unit No 2
PLAN
PROFILE
Ground Surface
¼ Inch space at joint
1 Foot Length
Tar paper collar
AGRICULTURAL DRAIN TILE
Grade 2 Inches Per 100 Feet
TRENCH
P = Drawing depth + 5 Inches
Outlet from Septic Tank
Siphon starts at this level
Drawing Depth
Siphon stops
Bell
Top of Floor
H
Note Before starting plant remove bell and fill both legs of siphon with water to level H
DETAIL OF SIPHON ONE TYPE
Y-Branch
Bend
Stop Plank
From Siphon
Drain Tile Joints covered with tar paper.
Main Carrier Joints Cemented
Y-Branch
DIVERTING GATE MANHOLE
TWO METHODS OF LAYING SUB-SURFACE TILE
Inlet
Automatic Siphon
Outlet
PLAN
Earth
30"
This type of trench may sometimes be used in heavy soils
Not hard-pan or impervious clay
Gravel or Cinders
Filling the trenches with gravel or cinders aids in the absorption of the liquid
Not necessary when soil is light and porous
Ground Surface
Manhole
Manhole
Ground Surface
Inlet
Sewage Line
Flow Line
Cast Iron Soil Pipe
Cast Iron Soil Pipe
Overflow
Vent
Cast Iron Soil Pipe
Outlet
Automatic Siphon
FLUSH TANK
SEPTIC TANK
SEWAGE DISPOSAL PLANT FOR PRIVATE HOME
VIRGINIA STATE BOARD OF HEALTH

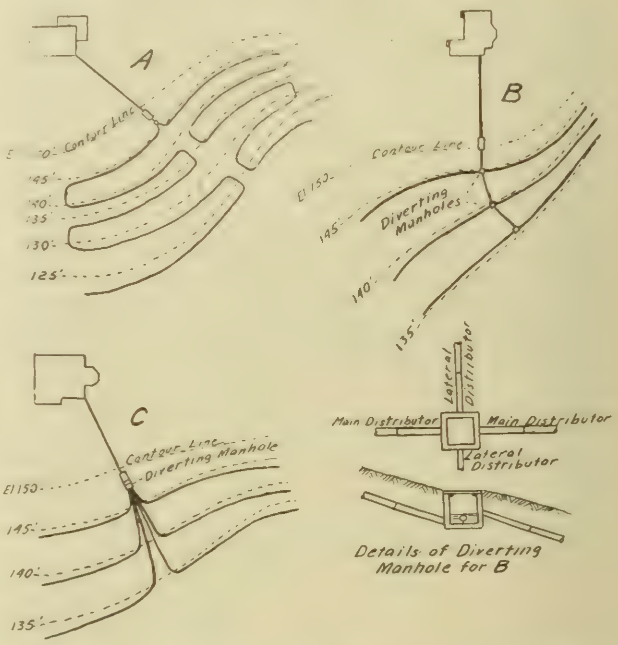
PLANS FOR A PRIVATE HOME BY THE VIRGINIA STATE BOARD OF HEALTH filling these with a porous material, such as cinders, gravel or sand. In extreme cases it may be necessary to underdrain the lines with tile drains. In very sandy soil, one line may be enough, but it will usually be better to place the lines three feet apart, or five feet in dense soils. The ends of the pipe should be turned upward to permit the flow of air. Two systems of drains should be laid and operated alternately, a week at a time. In sandy soil, tarred paper or pieces of pipe of a larger diameter should be placed around the joints. These lines of tile drains should not be laid within a hundred feet of a well.

The Virginia Health Bulletin of March, 1917, says: The area selected must have a sandy or gravelly top soil. When the soil is heavy clay or impervious, or where the ground-water level is only 2 or 3 feet below the surface, the system will not be satisfactory. Much depends upon how accurately the distributing lines are laid. The grade should be 2 inches per 100 feet. Parallel lines are usually spaced 4 feet apart. If the area is not to be plowed, the depth of the trench may be reduced to 12 to 15 inches. The 3-inch tile is usually best unless the soil is heavy, in which case the 4-inch size is often used. A space of one-fourth inch is left at each joint and, to prevent the earth falling in, the joint is covered with tar paper or a special earthenware cap. Gravel or cinders may be placed over the joints. A double system of underdrains is advocated. The amount of tiling required depends on how great is the volume of sewage and how porous the soil. In sandy or very porous soils, provide about 25 feet of tiling per person for each unit. On this basis, for five people 125 feet of tile in each unit (or a total of 250 feet) would be required. In more compact soils, a greater amount must be provided, often as much as 50 to 75 feet per person per unit. The lines are usually from 50 to 100 feet in length. If the soil is quite heavy, the trenches may be filled with cinders or gravel to within 3 inches of the top.

New York recommendations, made in 1918, by Theodore Horton, state sanitary engineer, state that, while no definite rule can be given, 10 to 20 feet per person will usually suffice in sandy soil; 40 to 60 feet per person in light loamy soils; but in clayey soil the method is not applicable. Three or four-inch lines are recommended, laid 12 to 15 inches beneath the ground, with open joints, and the tile lines laid not closer than 4 feet. The grade is suggested as 6 inches per 100 feet. Especial care is recommended in protecting the joints, so that the pipe may not sift full of earth or sand. Stress is also laid on the arrangement, especially where the grade is steep, and the recommended arrangements are shown in the accompanying sketch.



PLAN FOR SUBSURFACE IRRIGATION ON GENTLY SLOPING GROUND
By New York State Board of Health



SUBSURFACE IRRIGATION SYSTEM ON STEEPLY SLOPING GROUND
By New York State Board of Health

Hoskins and Young, writing in a 1918 issue of the Kansas State Board of Health recommend a grade of 3 inches per 100 feet, and depth of about 18 inches. If the soil is open and sandy, 200 feet will be sufficient for the ordinary residence, while if the soil is of closer texture, 300, 400 or more feet will be necessary. The system is not well adapted to tight and retentive clay soils, though it has been used successfully for a time under such conditions. One or more lines of tile may be used. In case more than a single line is used, great care should be taken to see that each line receives its proper share. A desirable, though costly, modification suitable for tight soil consists of a trench about four feet deep, filling the lower three feet with cinders or gravel, and then laying the 3-inch tiles at the surface of this.

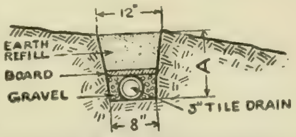
The present attitude of the North Carolina State Board of Health is that conditions vary so much in the different portions of the state that any recommendations as to amount are too general to be of value. In a bulletin issued in 1912, one foot or slightly more of 4-inch tile for each gallon of sewage expected daily is recommended. In ordinary soil, 4-inch disposal tile may be used, while in loose, porous ground, 5-inch, or 6-inch, pipe works well. If a siphon is used, the capacity of the tile line should be from 10 to 50 per cent more than the siphon.

Maryland recommendations, as given out in 1916, are as follows:

Persons	Feet, light soil	Feet, heavy soil
4	140	300
6	210	450
8	280	600
10	350	750

Warren, writing in the year book of the Department of Agriculture, recommends an outlet for each 30 gallons of siphon dose, with the ends of the lines practically flat. The ends of the runs should be vented. The capacity of the tile lines should about equal the siphon discharge.

Frank and Rhynus, of the United States Public Health Service, recommend that the tile system be divided into two parts, issuing from opposite sides of the control box. The piping should be of 3-inch agricultural tile with ends spaced about one-fourth inch apart. The length of trench necessary per person varies with the porosity of the soil, but 40 lineal feet per person is suggested as a conservative figure. Where the soil possesses extreme porosity the tile may be laid directly in the soil, but where practicable, and where there is the slightest question as to the degree of porosity of the soil, it is suggested that the layer of broken stone or gravel shown in the illustration be used in order to increase the life of the trench. The flat board covering the pipe is intended to prevent the upper layer of the soil refill from finding its way into and clogging either the tile piping or the lower portion of the trench. The tile line should be laid out to follow the contours and should be carefully laid with a grade of about 2 inches per 100 feet.



SECTION OF TILE TRENCH
By U. S. Public Health Service

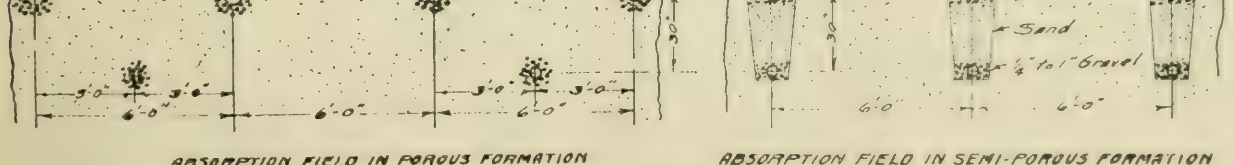
Washington (1916) recommends 160 feet per family, with a fall of 2 to 3 inches per 100 feet. Mississippi (1913) recommends a fall of one inch in 25 feet. Illinois (1916) suggests that tile lines under average conditions in that state will require about 100 feet of length per each member of the household. Gillespie (1918) gives the requirements as 40 to 100 feet of tile line per person, with no individual line over 100 feet long, and no lines within 6 feet of each other. The fall is given as 2 inches per 100 feet.

The 1919 issue of the Maine Health Bulletin carries recommendations by Dr. H. D. Evans, as to treatment of septic tank effluent. He states that in sandy or gravelly soils, which are the best for disposal of tank effluents, there should be allowed at least 35 feet of open-joint lateral per person. As closer grained and more compact soils are employed, the length per person must be increased, even up to 80 or 90 feet. In clay formations a modification of the system must be used. The laterals should be spaced at least 6 feet apart, and preferably double that distance. The depth of tile line should not be over 12 inches, as the bacterial activity of the soil decreases rapidly below that depth. Where only clay is available, it is necessary to make an artificial filter bed. Trenches 42 inches deep are dug and filled to within a foot of the top with cinder or other porous material. Sometimes a second tile line in the bottom is needed to carry away the effluent.

Ohio (1916) recommends a double system, each part connected to its own siphon. Each part should have a capacity at least 10 per cent in excess of the effective capacity of the dosing chamber. The distributing lines may be 6 or 8 inches in diameter, preferably the latter, to reduce the cost of trenching. The use of 6-inch tile will probably lengthen the life of the system, but increase the initial cost. For the distributing lines, hard-burned tile is preferable. These should be laid with one-quarter-inch joints and surrounded with one-quarter to one-half-inch gravel. It is advisable that the tile be covered with at least 12 inches of loam or soil. Small strips of heavy paper may be placed over the upper portion of each joint to prevent the washing of the finer material above into the distributing tile. About three feet beneath the distributing lines, 4-inch drain tiles are placed to prevent the accumulation of ground water in the filtering medium. The 8-inch tiles should be placed not less than five feet apart, and the 4-inch drains midway between. The distributing tile should be laid on a slight grade of not more than 3 inches per hundred feet.

Florida has been considering proposals to base the amount of tile on the number of people per acre, with tile lines spaced six feet apart. This has not yet been adopted. Florida is very largely a sand formation, and probably more than any other state could successfully apply a fairly general rule. It is suggested to base the rules on a maximum of 1,250 persons per acre.

Wisconsin gives most detailed requirements. For a small home, an absorption trench is recommended. The distribution pipe should be laid

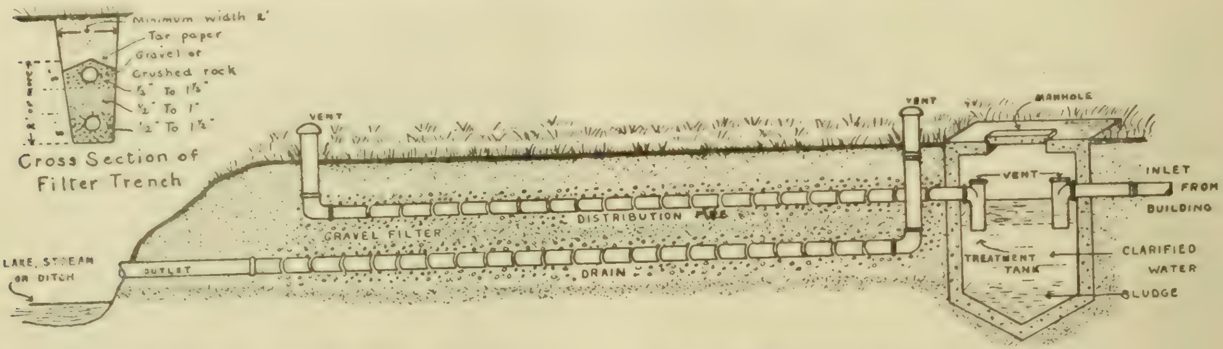


ABSORPTION FIELD IN POROUS FORMATION *ABSORPTION FIELD IN SEMI-POROUS FORMATION*

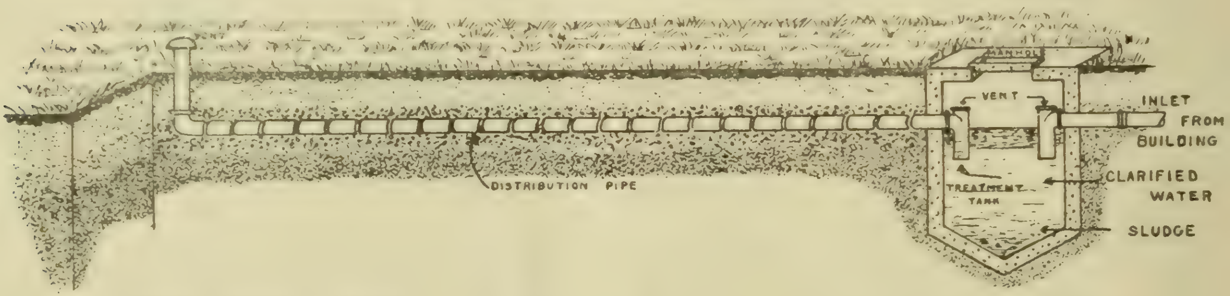
SECTIONS OF ABSORPTION GROUNDS, SHOWING DISTRIBUTION TILE AND DRAINS.
By Ohio State Board of Health, Division of Sanitary Engineering.

with a grade of 4 inches per 100 feet, and should be either a 5-inch or a 6-inch tile, laid with open joints, three-eights of an inch apart. A layer of crushed rock or gravel, one-half to one and a half inches in diameter, should surround the pipe. This material should be covered with tar paper. The absorption trench should have a length of 5 to 10 feet for every 30 gallons of liquid to be disposed of per day. Where a dry well and underground filter are combined, the amount of tile required is 5 to 10 feet for every 50 gallons of sewage per day. This underground filter consists of a trench, having a bottom drain, filled with cinder or other porous material, on top of which the effluent line discharges. With the drainage tile disposal system, which may be used where the ground for a depth of 3 to 6 feet is sandy and gravelly, the lines must be laid 15 feet or more apart, with a grade of 2 inches per 100 feet. The joints are left one-fourth inch apart and blinded with burlap or broken stone. The amount of tile laid should vary from 20 feet to 100 feet per person, depending upon the character of the soil.

It is impossible to generalize for conditions vary so much, even in all-sand sections. In general it is economy in the long run to put in plenty of tile. In tight soils, it may be cheaper to use the filter trench. This, as recommended by the writer (and he usually recommends it in preference to the ordinary system in the clay soils of the Carolinas), consists of a trench about four feet deep and two feet wide. A small drain is laid in the bottom, to carry the effluent to a nearby ditch, stream, or drain, and the trench filled, to within a foot of the top, with cinder, gravel, or broken stone. The effluent line is laid on top of this. Ends of both lines are vented. A very good effluent is usually secured. About 3 to 5 feet of this will usually be sufficient for each person, in the average home installation.



SEWAGE DISPOSAL SYSTEM FOR A SMALL HOME—TANK AND UNDERGROUND FILTER, WISCONSIN



SEWAGE DISPOSAL SYSTEM FOR A SMALL HOME—TANK AND ABSORPTION TRENCH, WISCONSIN

New Orleans Waterworks Notes

Some interesting features of the operation of this system last year, especially the purification plant. How the death rate has fallen.

New Orleans, La., like other cities, suffered in the upkeep of its public services because of material and labor prices and conditions during the year 1919, the report for which year has recently come to hand. The pumping plant has reached the practical limit of its capacity and the distribution system needs to be not only extended but also increased in capacity by the addition of one or more large mains. The quantity of water treated for consumption increased from 34,360,000 gallons per 24 hours in 1918 to 38,719,000 in 1919.

PURIFICATION

During the year the cost of operating the purification station at Carrollton was $118,947, or $9.04 per million gallons. This was divided as follows, the items being the average cost per million gallons treated: Labor, attendance and supervision, $3.42; labor, unloading, crushing and storing chemicals, $.59; lime, $3.26; iron, $1.07; liquid chlorine, $.14; supplies, tools, car fare, telephone, ice, etc., $.27; machinists' labor furnished by pumping station, $.08; labor and material furnished by pumping station for power, heating and lighting, $.23. In addition to this, $3,298 was spent in betterments and additions, $11,275 in care of park and grounds, and $122 for special war protection.

At the Algiers purification station, the cost per million gallons was $25.59, of which labor, attendance and supervision cost $18.23; lime, $3.70; iron, $1.22; hypochlorite of lime, $.56; labor and material furnished by pumping station for power, heating and lighting, $.78; machinists' labor furnished by pumping station, $.14.

All figures for cost are exclusive of interest and depreciation charges and pro rating of general and overhead expenses. The figures of cost per million gallons are based on the actual quantity of water treated during the year as shown by corrected venturi meter readings, namely, 13,158 million gallons, exclusive of charges for high and low-lift pumping. Wash water was estimated to cost 7.02 cents per million gallons of water filtered. Cleaning reservoirs cost 9.06 cents per million gallons of water filtered, excluding treated water wasted in draining reservoirs for cleaning. The total gross cost of delivering filtered water to the distribution system at the plant, exclusive of interest and depreciation charges, but including cost of pumping as well as purification, was $20.37 per million gallons, or $21.54 if betterments and care and maintenance of the park and grounds are included.

At Carrollton the wash water used varied from 0.1 to 1.4 per cent, averaging 0.35 per cent. At Algiers the wash water varied from 0.2 to 2.7 per cent, averaging 0.6 per cent. At Carrollton the average amount of lime used was 4.60 grains per gallon and of iron was 0.69 grain, this being the least amount of lime and the largest amount of iron used during the past five years. At Algiers the average amount of lime used was 5.06 grains and of iron 0.94 grain.

The results obtained by softening and purification are indicated by the following figures (in parts per million), the first in each case being before treatment and the second after treatment. Nitrogen as albumenoid ammonia, 0.350 to 0.035 (free ammonia, nitrites and nitrates were unchanged). Oxygen consumed, 7.0 to 2.15; chlorine, 9.65 in each case; alkalinity, 97 to 41; incrustants, 22 to 25; suspended solids, 650 to 0; dissolved solids, 190 to 100; half-bound carbonic acid, 42 to 0; free carbonic acid, 8 to 0; oxygen, 9 in each case; color, 10 to 5; turbidity, 600 to 0; silica, 11 to 10; iron oxide, 0.13 to 0.05; calcium, 38 to 15; magnesium, 8 to 3; sulphuric anhydride, 19 to 21; bacteria in gelatin at 20 degrees, 2600 to 31; bacteria in agar at 37 degrees, 1900 to 17.

In cleaning the reservoir system at Carrollton 150,000 cubic yards of wet mud was removed, which is estimated to be equivalent to 50,000 cubic yards of dry material. The removal of this cost $2,581 for labor and the use of water of a calculated value of $1,231, or a total cost of $3,812, or $.29 per million gallons of water treated, or 8.4 cents per cubic yard of dry material removed.

METERS

During the year, 64 per cent of the total consumption was recorded by meters. It was estimated that about 20 per cent additional was passed by the meters but unrecorded and that the remaining 16 per cent was used for sewer flushing, street sprinkling, fire houses, unauthorized uses, leakage and waste from the distribution system and other minor uses and losses. On January 1, 1920, there were 55,196 meters in use, 328 of which had been manufactured by the sewerage and water board of the city. Of these latter, 178 were 4-inch and 131 were 6-inch; one was a venturi, 231 were underwiter meters, and 96 were for special service. Of the total number of meters 460 measured free consumption, 123 being on schools, 53 on asylums, 51 on engine houses, 46 on water troughs, 44 on parks, 30 on municipal buildings, 29 on hospitals, 27 on markets, 26 on Sewer and Water Board services, 19 on police stations, and 12 on libraries. The average amount used by each of these was considerably larger for hospitals than any other service, with police stations and municipal buildings next, and asylums not far behind. The total consumption of these free consumers for the year was 680,045,000 gallons.

During the year 6,044 small meters were repaired and 444 large meters were inspected and repaired in place. Most of the meters have been in service for over five years and it is expected that the department will have to repair between 10,000 and 15,000 meters each year in the future, and work had been begun upon a new meter house and an increased testing equipment to meet this requirement. In addition to repairing, 2,669 meters were tested, the greater majority of these being ⅝-inch, the sizes including two 12-inch and one 16-inch. The cost of testing meters was $6,459 and of repairs and maintenance, $14,421. In addition there was $7,913 of department expenses, overhead expenses and expenses for the yard, stable, team, auto and tools chargeable to this service.

RESULTS OF DRAINAGE, SEWERAGE AND WATER SUPPLY

A table is given in the annual report showing the effect of the sewerage and drainage and public water supply upon the health of the city. The 40 years from 1880 to date is divided into 10-year periods. In the first decade from 1880 to 1889, inclusive, there was no adequate drainage, foul gutters and unscreened cisterns were everywhere and mosquitos abundant. During the second decade the conditions were the same, but with cesspools increasing and overflowing often into the gutters. From 1900 the drainage commenced to improve the conditions of soil saturation and after 1906 sewers also acted to drain the soil and to receive house connections. By 1910, 20 per cent of the premises were connected with sewers and 38 per cent were connected with the waterworks system. Following that date, further connections with both systems increased rapidly and the drainage improved. By 1919 practically all the well-built-up areas were drained, 93 per cent of the premises were served by sewers and 96 per cent by water. We have, therefore, the first two decades increasing in unfavorable conditions and the last two decades with increasingly favorable conditions.

The death rates per 100,000 from malaria for the four decades were 156, 104, 26 and 7, respectively, which had fallen to 4 in 1919. The rates per 100,000 for typhoid were 21, 39, 38 and 21, respectively, with 13 for the year 1919. The death rates per 1,000 from all causes have steadily fallen, being 28.6, 27.2, 22.6 and 20.6, with the rate for 1919 being 18.8.

The most remarkable of the above figures are those for malaria, which figures were decreased first by screening of cisterns and other precautions, but the fall from the average of 104 to an average of 26 in 10 years was due largely to the drainage of the soil. The reduction from an average of 156 to 4 in 1919 is one of the most remarkable on record in this country for any disease. The typhoid rate reduction is not so favorable, having fallen from 39 before the sewers began being used to 21 during the last decade. Even the rate for 1919 shows room for improvement.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

Driving Sewer Tunnel in Rock

CITY ENGINEER'S OFFICE

November 13, 1920.

Editor of Public Works, New York.

Dear Sir:

This city is planning on building a tunnel sewer 6 feet in diameter and 800 feet long through solid limestone at a depth of 25 feet beneath the surface. As tunnel work is unusual and perhaps occurs once in a lifetime in practice of an engineer, which is the case with me, I am seeking information in regard to what equipment is needed for a job of this kind and also some idea of how much work or number of lineal feet of tunnel can be accomplished in a certain time so that I can make an estimate that will be approximately correct, and therefore kindly ask for a little help through your information bureau.

My intention is to sink shafts about 200 feet apart and work two gangs of men tunneling toward each other.

For your convenience and to take up as little of your time as possible, if you will kindly answer the following questions by filling in the blank spaces.

What is your opinion as to what power is best to use to operate the rock drills, steam, compressed air or electricity?

How many men can conveniently work in each gang?

How many power drills would you advise to use?

Approximately how many lineal feet of tunnel can be driven in 9 hours?

Answers to the above questions will be greatly appreciated as they will be a great help to us.

Yours truly,

City Engineer.

To this we replied as follows: As we do not know the character of the limestone formation, whether it is regular or irregular, hard or soft, or how it breaks with explosive, which can only be determined by trial, our reply is only approximate and is based on the assumption that the stone is medium hard and homogeneous and that conditions are normal.

No. 1—For tunnel construction there is practically no choice; compressed air drills should be used.

No. 2—A maximum of four men is required in each gang.

No. 3—The most desirable equipment for drilling a small tunnel heading like this is two Drifter drills mounted on columns, although equivalent work can be done with four Jackhammer drills.

No. 4—With this equipment under ordinarily favorable conditions drilling for a 6 linear foot cut can be made in one 8-hour shift, and the muck can be removed in another 4-man 8-hour shift; but as considerable time is necessary for tunnel ventilation it is impracticable to run a third shift in 24 hours. And as 6 feet is a desirable limit for the depth of holes, all the work can be accomplished in 8-hour shifts.

The number of men and drills above estimated is for a single heading which, allowing 25 working days per month, would require between 5 and 6 months to drive the tunnel from one portal to the other. If driven simultaneously from two portals the time would be 3 months or less; if from two portals and one shaft, four headings, only about 6 weeks, exclusive of shaft sinking, would be required; and if headings were driven simultaneously in opposite directions from the portals and from the three shafts mentioned, the actual time should be reduced to about three weeks at the expense of a greatly increased outlay for drills, air compressors and other equipment.

The equipment necessary for driving one heading would suffice for sinking one shaft, on which operations could be maintained continuously for three 8-hour shifts daily, giving a progress of 7 or 8 linear feet per day.

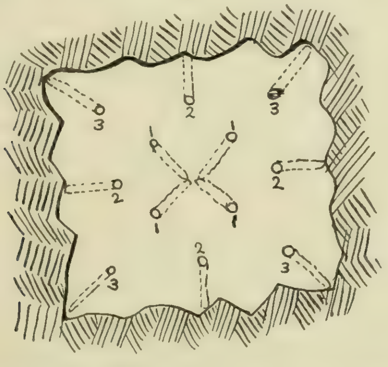
These specific answers were supplemented by the following general discussion of the subject.

NUMBER OF SHAFTS AND HEADINGS

The rapidity with which the tunnel can be driven depends almost entirely on the number of headings provided, which may be any number from one up, according to the urgency of the work and the amount and character of the equipment on hand or that can profitably be secured for this piece of work.

If no great urgency is involved, the work can be entirely completed from a single heading with the minimum cost of equipment and with very little extra cost for labor or superintendence. If made in this way it is also possible to utilize drills and compressors of a type that, although not ot the highest possible efficiency for this work, are still effective tools, have the merit of being very light and portable and are adapted to many kinds of ordinary construction work that would make them available for all sorts of city requirements, thus being valuable tools to keep in stock and verv easily purchased or sold in the market.

A tunnel of this length, under ordinary conditions could be advantageously driven from the two portals without the use of shafts or it could be driven simultaneously from the portals and from two headings at the foot of one shaft, or from four headings at the feet of two shafts, or from six headings at the feet of three shafts, making a total of eight headings, which would greatly expedite the work but would involve the extra labor for sinking the shafts and a considerable sum for the purchase or the rental of eight times the minimum amount of equipment. These are matters wholly of expediency, to be determined in every case by a fair consideration of the local requirements.



LOCATION OF HOLES IN 5x5-FOOT SHAFT

SHAFT SINKING

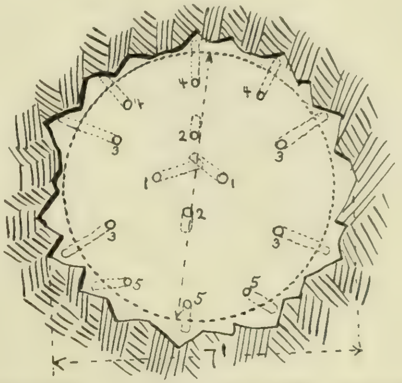
In this case the depth below the surface is so small that each shaft should be sunk in three or four days, involving a direct cost of perhaps $300 minimum for labor and supplies, besides which it would be necessary to provide hoisting equipment and maintain it at the shaft during construction. The equipment for excavating the shaft would be the same as that required for driving one heading and would, of course, be used for that purpose after the completion of the shaft.

For such a short shaft serving so small an amount of tunnel excavation, a minimum 5 x 5-foot rectangle would suffice, which would only provide clearance for the hoisting bucket in which the men would have to ride up and down, thus suspending the handling of material whenever entrance or exit was required.

This shaft would require about 12 holes arranged and inclined as indicated in the diagram. These holes, about 6 feet long in vertical projection, might have actual lengths of 6 to 7 feet and would be expected to break rock to a depth of about 5 feet. They can be drilled most advantageously by three DCR-13 Jackhammer drills weighing 55 pounds each, and requiring three men and a helper to operate them and a shift of three muckers to remove the rock. As no time is required for ventilating the open shaft, the work can proceed continuously day and night.

The Jackhammer drills are particularly convenient for cutting asphalt and concrete pavement, for block drilling, occasional blasting and various purposes and can be operated by a small size portable compressor. They are not, however, as suitable for drifting the tunnel headings, which can be best done with two drifter machines mounted on columns which have standard lengths of 6 feet or 8 feet, but can be ordered of any required length. For shaft sinking, the two drifter drills can be mounted on a column set horizontally. In either case, one extra drill should be provided to be held in reserve while the others are operating.

Each drill requires a water pressure connection for the feed and a 50-foot hose connection for air pressure. For three drills there should be provided 12 sets of steels, so that one set can always be at the smith shop for sharpening. The steels should be 8 feet long and will penetrate about 7 feet and break about 6 feet of rock. The double taper cross-bits of 14 degrees and 5 degrees are made of hollow 1¼-inch round steel with lug shanks. Although a drill sharpening machine is desirable, for so small a job it will be possible and probably economical to sharpen them by hand in a blacksmith forge.



LOCATION OF HOLES IN TUNNEL HEADING

DRIFTING THE HEADING

To allow for a concrete lining with an interior diameter of 6 feet, the heading should be at least 7 feet in diameter and can probably be drilled with 14 holes arranged about as indicated in the diagram, but with their lengths and positions subject to change according to the nature of the rock and the manner in which it breaks.

The holes can be drilled with two drifter drills, a special type of machine, sturdy, light and compact, and particularly effective for this kind of work. The drills should each be mounted on a separate column and be operated by a driller and a helper. Each drill will make from 40 to 50 linear feet of hole per 8-hour shift. Or the holes can be drilled by four BCR 4-30, or if necessary by the DCR-13, Jackhammer drills mounted two on each column.

In either case, the air supply required will be about 240 cubic feet per minute of air at from 70 to 100 pounds pressure, preferably 85 pounds. This can be supplied by a 12 x 12-inch electric stationary air compressor for three Jackhammer drills, and one Jackhammer and one drifter drill can be supplied by an 8 x 8-inch portable compressor delivering 170 cubic feet of air per minute. Such a machine is very popular for pavement repairs and miscellaneous work, operation of pneumatic tools, etc., and weighing only about 7,500 pounds, is easily portable. It is a complete unit operated by a gasoline motor and is mounted on wheels. The stationary compressor is belt driven, weighs about 6,600 pounds and requires a motor of 60 brake h. p. To provide a supply of from 200 to 300 feet per minute it should be equipped with a 36-inch receiver 8 feet long weighing 1,350 pounds. The compressed air should be discharged through a pipe 4 inches in diameter, which, however, can be reduced underground to 2 inches.

BLASTING AND MUCKING

The holes in the heading are divided into five groups which, in the diagram, are identified by numerals which also indicate the sequence in which the groups, as units, are to be successively fired. The No. 1 holes should be about 4 feet long parallel to the axis of the tunnel and should each be loaded with three cartridges. No. 2 holes 6½ feet long and No. 3 holes about 7 feet long, should each be loaded with six cartridges, No. 4 holes also 6 feet long with five cartridges and the No. 5 holes or lifters, about 7 feet long, with seven cartridges. Forty per cent dynamite should be used and the cartridges very well tamped.

In order to insure the successive firing of the different groups of holes, each group should have the fuses cut of different length, the longest, of course, for the last fired holes, and there should be slight irregularities, which naturally occur, in the length of the fuses in the same round, so that the separate explosions may be distinguished and counted, and in case any fail to explode the muckers can be warned of the fact and excavate carefully so as to avoid accidental explosions. With the ordinary fuse burning at the rate of about 1 foot per minute this detail is easily arranged.

Electric firing is somewhat more efficient than fuse firing but it involves the purchase of electrical equipment and the delay of wiring. The shots are all simultaneous, therefore producing the maximum effect, but if any charges are missed there is no way of determining it and the danger of their accidental discharge later is much greater than when fuses are used and a slight loss of efficiency is produced by the separate explosions.

Especial care should be taken in locating and drilling the No. 5 lifter holes, watching the effect of the blasts and varying them so that they will not only break the rock to the bottom of the tunnel, but will lift it up and throw up and backwards the muck accumulated from the previous discharges, thus facilitating the muckers' operations.

It will probably be found most advantageous to load the muck by hand into small dump cars on a narrow-gauge service track pushed by hand to the portal or shaft, but if the work is entirely from one portal or from two portals, making a longer haul, the work may perhaps be expedited by the installation of a tugger hoist, a compressed air machine occupying less than 2 feet in its dimensions which can be mounted on a column; it weighs only 350 pounds, exerts a 1,000-pound draw-bar pull and consumes about 150 cubic feet of air at 80 pounds per minute. This machine can handle the loaded cars on a moderate upgrade, and the empties can return by gravity, or it can be arranged with a return cable led around sheaves at both ends so as to haul the car in both directions, the return cable being carried under the tracks where it is out of the way.

If the tunnel is to be driven from only one heading, one extra drill should be provided as reserve, and more reserve drills (although not quite in proportion) will be required if it is done from several headings.

To operate four headings there would be required an XB-1 compressor with a capacity of 560 cubic feet of air per minute; to operate six headings an XB-2 compressor with a capacity of 835 cubic feet of air, or for eight headings an XB-2 compressor with a capacity of 1,100 cubic feet of air, all of these compressors being of the stationary type and being belt driven from steam, electric or gasoline motors, as found most convenient.

The description of equipment here given is intended merely to show what is required for the general operations, and to provide for comparisons. Therefore all of the items are selected for the sake of uniformity from the same catalog, that of the Ingersol-Rand Company, and are such as are generally recommended by that corporation for general construction of this nature under ordinary conditions. Corresponding equipment is, however, manufactured by other concerns and may be selected on its merits and to secure the greatest convenience and economy, or for special results if demanded.

Hetch-Hetchy Cost-Plus Contract

A rehearing of the Hetch-Hetchy cost-plus-fee contract of the Construction Company of North America in the suit by a taxpayer to prevent Auditor Thomas F. Boyle from transferring to the construction company an initial payment of $276,000 called for by the contract was denied on November 16 by the Supreme Court. The project had been halted for want of funds and this decision paves the way for a renewal of the work.

Recent Legal Decisions

CITY'S PROBITION OF GARBAGE REMOVAL EXCEPT BY LICENSEE OR CONTRACTOR

A restaurant keeper on behalf of himself and all others similarly situated in the city, sought to enjoin the city of Buffalo from enforcing an ordinance regulating the collection and transportation of garbage. The plaintiff had contracted with a farmer to collect his garbage, to furnish receptacles, to clean them, to return the silver and tableware found in them, and to pay the plaintiff a specified sum for the stock food taken away in them. The injunction was denied on the authority of City of Rochester v. Gutherlett, 211 N. Y. 309, 105 N. E. 548, where the New York Court of Appeals held that it is within the power of a municipality, not only to impose reasonable restrictions and regulations upon the manner of removing garbage, but also, if it sees fit, to assume exclusive control of the subject, and to provide that garbage and refuse matter shall only be removed by the officers of the city, or by a contractor hired by the city, or by some single individual to whom an exclusive license is granted for the purpose. The New York Appellate Division, which gives the decision, Eddy v. City of Buffalo, 184 N. Y. Supp. 51, adds: "If it (the ordinance) is not valid as against a restaurant keeper who transports his kitchen garbage through the public streets himself or by his employees, still the plaintiff is not in a position to raise that question, as the one who transports the garbage in the case at bar is not an employee, but a contractor."

MERE PHOMISE TO DO WORK FOR LESS THAN CONTRACT PRICE INEFFECTUAL

In an action for the balance of the contract price for excavating a drainage ditch a witness was allowed to testify that after the contract and bond had been executed and approved by the county court, and it had adjourned, he called the plaintiff's attention to certain omitted items of cost, whereby the apportioned assessment would not equal the entire cost of the project, and that the plaintiff said he would have to do the work for whatever was left. On appeal it was held that this was not admissible. McWilliams v. Drainage Dist. No. 19, 224 S. W. 35. It was an attempt to vary by parol a written contract. Such contracts as that in question cannot be modified by parol agreement. Besides, the contract was fully complete in every way, and there was no consideration for any such promise. In addition to this, it was not made to the opposite party to the contract, the engineer, nor was it reported to the court for approval and confirmation.

LIMITATION IN SPECIFICATION OF PAVING MATERIAL

The Illinois Supreme Court holds, Schoellkopf v. City of Chicago, 128 N. E. 337, that specifications for paving blocks requiring that the oil used for treating the blocks be a distillate obtained wholly and entirely by distilling coal tar and free from any adulteration and to contain a certain amount of tar acids, etc., were unauthorized and unlawful, under Illinois Local Improvement Act, par. 74, providing that all contracts for the making of any public improvement to be paid for wholly or in part by special assessment or special tax shall be let to the lowest responsible bidder and any provision which tends to restrict such competition is unlawful, where the specifications provided for an oil produced by but one of the many distillers of coal tar. The court said: "It is, of course, of much importance that a municipality should be able to obtain the best material and secure the best and most enduring improvement, but at the same time, under the statute, it must not be the victim of monopoly in procuring the best results."

CITY COUNCIL'S AUTHORITY TO ISSUE PAVING CERTIFICATES

The Minnesota Supreme Court, in Pike v. City of Marshall, 178 N. W. 1006, construes chapter 65, Minnesota Laws of 1919, to authorize the city council of a city of the fourth class not having a home rule charter to issue certificates of indebtedness to provide funds for the construction of a pavement without submitting the question to the electors for approval.

SUIT BY SUB-CONTRACTORS ON BOND OF CONTRACTORS FOR PUBLIC WORKS

Act of Congress, August 13, 1894, as amended by Act, February 24, 1905, provides that if no suit is brought by the United States on the bond of a contractor for public works within six months from the completion and final settlement of the contract, persons furnishing labor and materials, payment for which has not been made, may bring suit thereon in the name of the United States. It is held, United States v. Brown, 266 Fed. 555, that a suit so brought in conformity with the statute will not be stayed because of the subsequent commencement of a suit by the United States in another jurisdiction.

PROVISIONS OF CONTRACT AS TO EXTRA WORK MUST BE COMPLIED WITH

A contract with a city for laying a pipe line provided that extra work should be paid for according to a prearranged schedule of prices, if authorized by resolution of the board of trustees. It is held, Contra Costa Const. Co. v. Daly City (Cal.), 192 Pac. 178, that the contractor under such a contract cannot recover thereon for extra work performed without prearranged prices or the approval of the trustees. A promise by the city engineer in charge of the work to the contractor that the city would make a fair settlement for such extra work would not be binding on the city, unless the engineer had power to order the work. This would in effect change the contract and brush away the safeguards the city had placed therein for its protection.

NEWS OF THE SOCIETIES

Dec. 13-16—AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS. Annual convention. Washington, D. C.

Dec. 16-17—THE KANSAS ENGINEERING SOCIETY. Annual meeting. Topeka, Kansas.

Dec. 18—MUNICIPAL ENGINEERS OF THE CITY OF NEW YORK. 16th annual dinner. McAlpin Hotel, New York City.

Dec. 27-Jan. 1—AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Smithsonian Institute, Washington, D. C. Chicago, Ill.

Dec. 28-31—AMERICAN ECONOMIC ASSOCIATION. Yale Station, New Haven, Conn. Atlantic City, N. J.

Jan. 19 — INTERNATIONAL CUT STONE CONTRACTORS' AND QUARRYMEN'S ASSOCIATION, Inc. Annual meeting. Congress Hotel, Chicago, Ill.

Jan. 19 — AMERICAN SOCIETY CIVIL ENGINEERS. New York City.

Jan. 25-27, 1921—THE AMERICAN WOOD PRESERVERS ASSOCIATION. Place of meeting to be announced later.

Jan. 25, 26, 27—ASSOCIATED GENERAL CONTRACTORS. Annual meeting, New Orleans. Secretary's Office, Washington, D. C.

Feb. 1-2—NEW YORK STATE ASSOCIATION OF BUILDERS. Convention. Rochester, N. Y.

Feb. 1, 2, 3, 1921—ONTARIO PROFESSIONAL MEETING in conjunction with the annual meeting of the Engineering Institute of Canada. Toronto.

Feb. 7—AMERICAN ROAD BUILDERS' ASSOCIATION. Annual convention. Coliseum, Chicago. E. L. Powers, 11 Waverly Place, New York City.

May 17-19—NATIONAL FIREMEN'S ASSOCIATION. Twenty-third annual convention. Fort Wayne, Ind.

June 7-9—NATIONAL FIRE PROTECTION ASSOCIATION. Annual meeting. San Francisco, Cal.

June—CONFERENCE OF MAYORS AND OTHER CITY OFFICIALS, State of N. Y. 12th Annual Conference. Elmira, N. Y.

June 6-10, 1921—AMERICAN WATER WORKS ASSOCIATION. Annual convention at Cleveland. Ohio. Secretary, J. M. Diven, 153 West 71st St., New York.

FIRST MEETING OF THE AMERICAN ENGINEERING COUNCIL

At the first meeting of the American Engineering Council, twenty of the twenty-one engineering organizations which have become charter members of the federation were represented—also the other engineering organizations which are considering charter membership but which have not taken final action. The Kansas Engineering Society was the only charter member that did not send a delegate.

The meeting was opened on November 18 by Mr. Humphry. Temporary officers were appointed and the business meeting began with the appointment of various chairmen of committees. A report providing for the selection of members of the executive board by the division of the United States into six districts was given by L. P. Alford. The executive board was named. The date for becoming a charter member of the federation was extended to July 21, 1921. After much discussion, Washington was decided on as headquarters of the Council.

On November 19, the report of the nominating committee was made. Herbert Hoover was unanimously elected president; Calvert Townley, W. E. Rolfe, Dexter S. Kimball and J. Parke Channings were unanimously elected vice-presidents; and L. W. Wallace, treasurer.

The first meeting of the executive board of the Council was held on November 20, at which the board endorsed Mr. Hoover's plan for an investigation of industrial wastes, authorizing him to form an organization for that purpose. This investigation is to include, among other special lines of inquiry, the aggregate loss to industry and to the public occasioned by strikes and lockouts, and the unemployment caused by the shifting of industrial currents. The engineer, Mr. Hoover asserts in his first address as president of the federation's Council, is the best man to bring about co-operation among the country's great economic groups of special interests.

AMERICAN SOCIETY OF CIVIL ENGINEERSN

Two committees were appointed at the meeting of November 9 by the board of direction of the society to study the external relations of the society, the action being taken on account of the negative vote upon entrance into the federation after the positive vote in April regarding active co-operation with other engineering and allied associations for the purpose of promoting the welfare of the engineering profession. The first committee will consist of the younger members who will consider and make recommendations concerning the relations of the society to other engineering bodies. The second committee will consist of all living past-presidents of the society who will review and transmit to the board the report of the other committee. The first committee is to finish its report by January 1, and the second committee is to have it ready to submit to the board by January 17.

BROOKLYN ENGINEERS' CLUB

The informal meeting on December 2 was held under the joint auspices of the Brooklyn Engineers' Club and the Automotive Service Association of Brooklyn. The speakers of the evening were G. T. McFarland, president of the Automotive Service Association, who described "Automotive Electric Requirements and Its Service"; H. R. Cobleigh, secretary of the National Automobile Chamber of Commerce, discussed "Service from the Manufacturers' Standpoint," and D. P. Cartwright, of the North East Electric Co., showed a moving picture film illustrating "Starting, Lighting and Ignition."

THE NEW ENGLAND WATER WORKS' ASSOCIATION

The November meeting of the New England Water Works Association was held at Boston, Mass., on November 10. Several interesting papers were read. Among these were "Air in Gravity Mains," by J. E. Ledoux; "Standard Schedule for Grading Cities and Towns of the United States with Reference to Their Fire Defences and Physical Conditions," by John S. Caldwell; "Operations of a True Siphon on a Main Supply Pipe," by W. R. Brann and Charles W. Sherman; and "Water Waste Surveys in Boston," by Frank A. McInnes. An amendment to the constitution was adopted increasing the dues of regular members from $4 per year to $6. The further business of the meeting was the nominating of officers for 1921.

IOWA SECTION OF THE AMERICAN WATER WORKS ASSOCIATION

At the sixth annual meeting of the Iowa section of the American Water Works Association on November 5-6, at Iowa City, the following officers for 1921 were elected: Chairman, Francis D. H. Lawlor, Burlington; vice-chairman, J. Chris Jensen, Council Bluffs; directors, R. E. McDonnell, Kansas City, and Homer V. Knouse, Omaha; secretary, Jack J. Hinman, Jr. The next meeting is to be held in Omaha next October.

ASSOCIATED GENERAL CONTRACTORS

At a meeting of the executive board of the Associated General Contractors at Washington on November 16, resolutions were unanimously adopted endorsing the action of the Lockwood Committee in investigating the building situation in New York, and plans were laid for securing the co-operation of the United States Chamber of Commerce and other employers' associations in support of this.

TORONTO ENGINEERS HEAR ADDRESS ON ST. LAWRENCE CANALIZATION PROJECT

In conjunction with the Canadian Deep Waterways and Power Association, a public meeting was held on the evening of November 10 by the Toronto branch of the Engineering Institute of Canada in the Mining building of the University of Toronto to hear addresses on the proposed St. Lawrence deep-water route by O. E. Deming of Windsor, president of the Canadian Deep Waterways and Power Association; E. L. Cousins, manager of the Toronto Harbor Commission; and Alex C. Lewis, member of the Ontario legislature and secretary of the Canadian Deep Waterways and Power Association. After the addresses, general discussion was invited in which a great number of the large attendance present took part.

J. M R. FAIRBAIRN TO BE NEXT PRESIDENT OF THE ENGINEERING INSTITUTE OF CANADA

The nominating committee of the Engineering Institute of Canada has, according to its usual custom, nominated but one candidate for the presidency, the nominee for next year being J. M. R. Fairbairn, chief engineer of the C. P. R. For each of the other offices two men have been nominated.

AMERICAN SOCIETY OF CIVIL ENGINEERS NOT TO BECOME MEMBER OF THE FEDERATED AMERICAN ENGINEERING SOCIETIES

In a letter ballot canvassed on November 8, the American Society of Civil Engineers, by a vote of 3,278 to 2,330, defeated the proposal that the society should become a member of the Federated American Engineering Societies, of which the American Society of Mechanical Engineers, the American Iistitute of Electrical Engineers and the American Institute of Mining Engineers have already become charter members.

NEW JERSEY HIGHWAY CONTRACTORS UNITE

Twenty-five contractors have co-operated in forming the highway Contractors' Association of New Jersey. The first meeting of the organization was held at the Trenton House, Trenton, N. J., on October 15. A meeting and banquet was also held on November 4, at which time the following officers were elected: President, J. F. Kelly; vice-president, Joseph Burke; treasurer, James Barrett; and secretary, Mr. Whelan.

CONSTRUCTION CONGRESS

At a meeting of the several representatives of contractors, sub-contractors, architects, engineers, and labor, held in Pittsburgh, October 2, the permanent organization of an executive committee to handle a Construction Congress was completed. Robert D. Kohn of New York was elected permanent chairman and Sullivan W. Jones of New York, permanent secretary. Plans were laid for calling a meeting of representatives of all elements in Chicago on or about February 1, 1921.

GENERAL MARSHALL MEETS CONTRACTORS IN TWENTY CITIES

To strengthen and develop the spirit of co-operation among general contractors throughout the United States, General Marshall began his active campaign as general manager of the Associated General Contractors with meetings of general contractors in twenty of the principal cities east of the Rocky mountains. At every city on his trip he has been met with most enthusiastic response from the leaders in the industry.

TORONTO BRANCH OF THE ENGINEERING INSTITUTE OF CANADA

At a meeting of the Engineering Institute of Canada on November 18, the question of zoning as a part of scientific town planning was discussed. A committee had been working on a report on this subject, but as the report was not completed in time, the evening's discussion was confined to a review of matters brought before the committee. The following points were emphasized: The benefits to be derived from zoning; the fact that each city in the province of Quebec has the power of planning and carrying out complete zoning systems; the results of traffic studies made by the Civic Transportation Committee of Toronto; and the Toronto Harbor Commission's activities in the matter of zoning.

THE OKLAHOMA CHAPTER, AMERICAN ASSOCIATION OF ENGINEERS

At a meeting of the Olkahoma chapter of the A. A. E., held at Oklahoma City on November 20, the subject of the danger to Oklahoma City's water supply resulting from recent floods in the North Canadian river was considered, and a permanent committee was appointed to give attention to the correction of the situation.

AMERICAN WATERWORKS ASSOCIATION, CALIFORNIA SECTION

The first annual meeting of the California section of the American Waterworks Section was held in San Francisco on November 13. Three papers of great interest were read, and several reports given. The business meeting was followed by a luncheon at the engineers' club and an automobile trip over the peninsula properties of the Spring Valley Co.

TEXAS SECTION, AMERICAN SOCIETY OF CIVIL ENGINEERS

At the fall meeting of the Texas Section of the American Society of Civil Engineers at Austin on October 20 and 21, the following officers were elected: President, J. H. Brillhart, Dallas; first vice-president, F. E. Giesecke, Austin; second vice-president, J. C. McVea, Houston; secretary-treasurer, E. N. Noyes, Dallas. A number of technical papers were then presented. A standing committee was appointed to work out details on a standard form of contract with arbitration clause and submit the same to the members by letter-ballot for approval. A committee on redistricting of the American Society of Civil Engineers reported in favor of the present District No. 11 and against any change. Committees were appointed to work on an Engineers' License Law and present the same to the legislature, and to bring in a resolution on the water power bill now before Congress.

PERSONALS

Fairchild, W. H., has resigned as city engineer of Galt, Ont., the resignation to take effect at the end of the year.

Brett, J. F., who since his return from abroad in March, 1919, has been assistant engineer in the Public Works Department of Montreal, has been appointed designing engineer of the Montreal Water Board.

Philips, Hector S., who before the war was in charge of the Sewer Drafting Section, Department of Works, Toronto, is now engineer of sewer design in the city engineer's office, London, Ont.

Zerbe, Luther K., of the firm of Zerbe & Pfouts, civil engineers and surveyors, who for the past twenty years has been engaged in municipal engineering, has been appointed assistant superintendent of the Canton, O., waterworks.

Calvert, Lt.-Col. L. L., has returned to the position which he held before the war, that of chief engineer with the Tidewater Building Co. of New York City.

Webster, George S., for many years chief of the Bureau of Surveys, Philadelphia, will shortly resign his position to become directing engineer of the Joint Pennsylvania and New Jersey Delaware Bridge Commission. The resignation will probably take effect some time in December.

Bloomquist, H. F., who at one time was engaged as city engineer of Ulm, Minn., and Mankat, Minn., and who later was appointed principal assistant engineer for the bureau of water, department of public utilities, St. Paul, Minn., has recently been appointed superintendent of the water department of Cedar Rapids, Ia.

Wells, Emery, who is considered a specialist on reinforced concrete construction, is now with Berkebile Bros., engineers, of Johnstown, Pa.

Ihrig, Howard K., formerly chief draughtsman, engineering works department, Dravo Contracting Company, Pittsburgh, Pa., is now in charge of the engineering department of the Heltzel Steel Form & Iron Company, Warren, Ohio.

Flanagan, C. D., Jr., is now engaged as engineer in the municipal service department of the Southeastern Underwriters' Association, Atlanta, Ga.

Smith, P. S., of the U. S. Geological Survey, and Holbrook, E. A., of the U. S. Bureau of Mines, have been appointed by the Interior Department to serve on the American Engineering Standards Committee.

Jones, H. S., valuation engineer of the Gulf, Mobile & Northern Railroad, has been appointed chief engineer, with headquarters at Mobile, Ala.

Babcock, Dudley P., formerly assistant engineer of the New York State Department of Highways, has been appointed assistant engineer, Bronx Parkway Commission, Bronxville, N. Y.

Williams, H. W., formerly assistant engineer in the electrical department of the Chicago, Milwaukee & St. Paul Railroad at Seattle, has been appointed special representative to the general superintendent of motive power at Chicago.

Mitchell, John S., formerly chief draftsman with the Niles Forge & Mfg. Co., Niles, Ohio, is now chief engineer and assistant manager of the Ohio Structural Steel Co., Newton Falls, Ohio.

Crumb, Edwin D., formerly in the engineering office of the Automatic Sprinkler Valve Co. of America, Youngstown, Ohio, has accepted a position as junior assistant engineer of the New York State Highway Department.

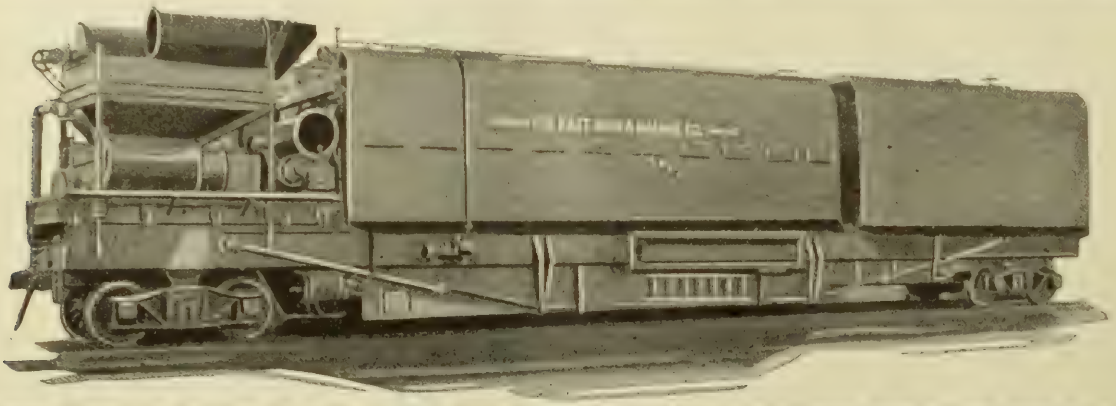
Moody, Walter D., managing director of the Chicago Plan Commission, with which he has been connected since 1907, died at his home in that city on November 21.

Bullock, Charles, contractor, of Brampton, Ont., died on November 15 at the age of eighty years.

Thomas, Chester A., engineer, died on November 11 at Dawson, Y. T., Canada. He was last connected with the Yukon Gold Co., Canada, for which company his most important activities were the construction and operation of several hydraulic mines, seven gravel dredges, three electric grain elevators, a 2,500 h. p. power plant with 5-mile water system and 50 miles of transmission lines.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations



NEW ASPHALT PLANT, 58 FEET LONG, READY FOR SHIPMENT. CAPACITY 3000 YARDS PER DAY

THE NEW MERRIMAN ASPHALT PLANT

The East Iron & Machine Company, which has been building the Merriman one-car steam-melting asphalt plants since 1905, announces that the improved Merriman No. 3 is now on the market, and several have already been sold.

The new plant, which has increased efficiency and is easier to transport and handle, is only 58 feet over all, and is the shortest complete railroad plant of its capacity on the market. The guaranteed capacity is 2,000 square yards of 2-inch topping, or 2,800 yards of asphaltic concrete, in a ten-hour day. Users of this plant are now laying over 3,000 yards of 2-inch topping in a ten-hour day.

The side girder sills are so constructed that they cannot sag or warp out of shape. The trucks are extra heavy, M. C. B. standard, with 6 x 11-inch journals, special hammered steel axles and chilled wheels. The 125-h. p. boiler is extra heavy, is a good steamer, and is very easy to clean. The power equipment is specially designed. The engines are of simplified construction, very heavy, and all parts are readily accessible.

The four melting kettles are constructed in one unit. Each kettle is equipped with two steam coils, made of heavy electrically welded pipe. These kettles are so arranged that air pressure can be used to facilitate discharge of the asphalt, and so that either air or steam can be used for agitation. Clean-out doors are placed at close intervals.

The patented sand drum is 5 feet in diameter and 25 feet long. No internal spiders are used, and four heavy I-beams act as spill plates and carry the sand so that it falls through the heat as the drum revolves. Spiral flights carry the material forward. The drum runs on special trunnions and a special riding ring, and is driven by outside gear segments. The capacity is approximately 25 tons per hour.

The mixer has a capacity of 12 cubic feet, is equipped with patented blades having renewable ends and can dump directly into motor trucks which run under the mixer platform.

The telescopic hot material storage bin holds 12 cubic yards or 15 tons, but can be easily closed down on platform without removing any parts.

The patented working platform, when extended for operation, permits trucks and wagons to pass under the mixer dump and is easily drawn within shipping length of the car and clears the end of the car frame.

Elevators on both sides of the plant feed the sand drum, so material can be stored on either or both sides. The hot material elevator is entirely enclosed in dust-tight sheet-steel housing, made in sections, which can easily be removed to facilitate packing for shipment. The fire box is arranged for burning coal, coke, wood or fuel oil, thus giving a choice of fuel at all times.

LITTLE WONDER TILE DITCHER

The Little Wonder tile ditcher manufactured by Edward Jeschke can be operated by either team or tractor power and rapidly cuts a clean, narrow ditch more uniformly and economically than it can be done by hand power.

It will cut from 2 to 3 feet deep at the rate of 1-3 mile per hour. With teams, it can be operated as fast as the horses can walk, digging easily to a depth of 30 inches. One of them was reported in two hours to have dug a trench that would have cost $42 if dug by hand.

INDUSTRIAL NOTES

The Austin Machinery Corporation, Chicago, Ill., has established ten primary district offices and warehouses and upwards of fifty subsidiary offices and agencies throughout the United States. Each warehouse carries a full stock of machines and parts.

Blaw-Knox Co., of Blawnox (Pittsburgh) has established a new sales district in the south, with headquarters at 408 American Trust building, Birmingham, Ala. Prescott V. Kelly is in charge of the new office.

Fairbanks, Morse & Co. has purchased the entire business of the Luster Machine Shop & Railway Equipment Co., 917 Arch street, Philadelphia, where a new branch will be opened under the management of Mr. D. W. Dunn. E. J. Luster, former president, will be manager of the machine tool division of the Fairbanks, Morse Philadelphia branch.

Inter-State Portland Cement Co., Des Moines, Ia., has been incorporated with a capital of $3,100,000. The officers are: President, Parley Sheldon, Ames, Ia.; vice-presidents, L. K. Nickols and W. B. Barney; secretary-treasurer, Paul W. Carroll; general counsel, George Cosson; chairman of the board, B. F. Carroll.

ATTRACTIVE PUBLICITY

So far as commercial publicity consists of a compelling and pleasing appeal to the eye, the Austin Machinery Corporation has achieved it in a series of art letter heads of artistic and typographical merit that are also so conspicuous that communications written below them will be very unlikely to go into the waste basket without more than the usual attention.

A set of eight artistic pictures are printed in colors across the full width of the top of the letter page, occupying from one-third to one-quarter of the total space. Each picture is an attractive landscape showing in the foreground a different important unit of Austin plant in operation and inscribed with a brief suggestive title. Pains have been taken to eliminate, as far as possible, the details, so that the type of machine and the character of its services are made prominent and an idea of efficiency is given without the study of perplexing minor features.

These pictures on letter sheets with tinted margins represent a considerable outlay which is justified by the effect of "class" that they convey.

PUBLIC WORKS

CITY COUNTY STATE

A Combination of "Municipal Journal" and "Contracting"

Entered as Second Class matter at the Post Office at Floral Park, N. Y., August 27, 1920, under the Act of March 3, 1879

Vol. 49 FLORAL PARK, DECEMBER 18, 1920 No. 25

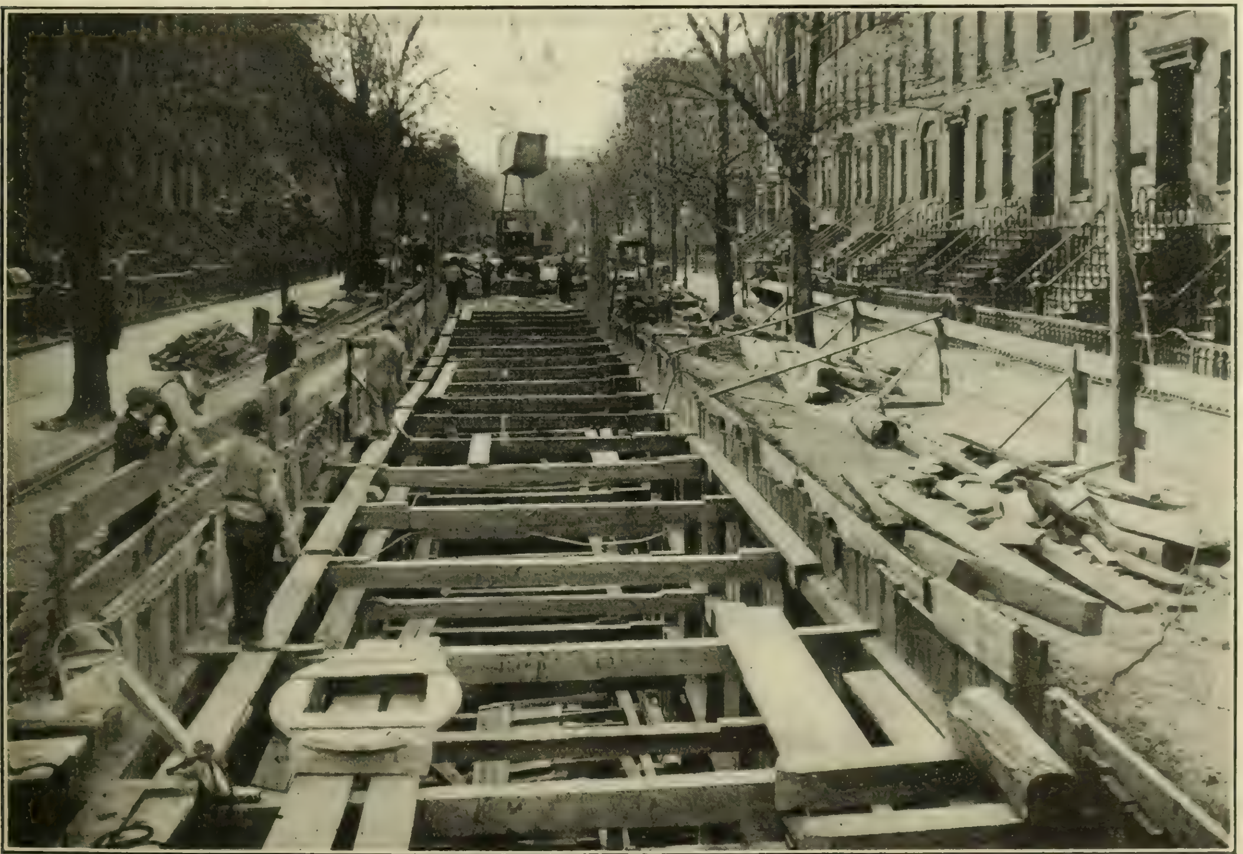
Repairing Greene Ave. Sewer, Brooklyn

About 2,300 feet of brick arch of 10-foot sewer replaced by concrete in deep open cut work and about 750 feet of defective brick arch for same 10-foot sewer reinforced by concrete arch built inside old structure.

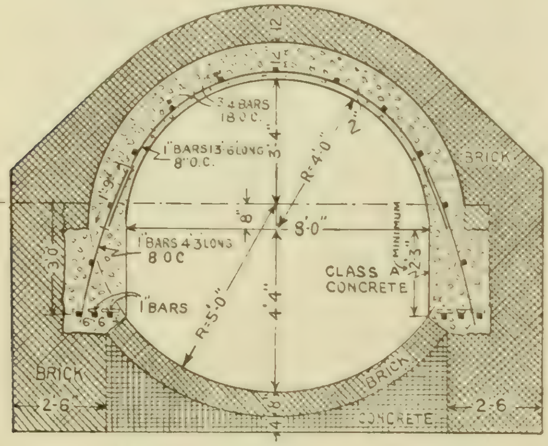
The Greene avenue sewer between Throop and Lewis avenues, Brooklyn, was a circular brick structure 10 feet in diameter inside with vertical walls 2½ feet thick, a 12-inch arch ring and an invert 8 inches thick on a concrete base 4 inches in minimum thickness. It was built many years ago at a depth of about 35 feet below the surface of the street in dry, sandy soil. Up to the springing line the sewer is still in good condition but in many places the arch has cracked, settled or broken so that it was considered unsafe, and plans were made for repairing a large portion of it.

INSIDE CONSTRUCTION

At the upper end, from Marcy avenue to Tompkins avenue, the flow in the sewer is so small that it was permissible to make a slight reduction in the cross section, and plans were made for cutting continuous longitudinal recesses 27 inches high, about 8 inches deep at the top, and about 20 inches deep at the base, below the springing



CABLEWAY HANDLING SPOIL FROM EXCAVATION TO BACKFILL STARTING SHEET PILES DRIVEN BY AIR HAMMER line on each side of the sewer to provide for skewback courses bonded to the side walls and made continuous with a concrete arch ring 12 inches thick within the old brick arch, supporting it and resting on the skewbacks cut through the old invert and into the side walls as shown in the cross section. The roof of the reconstructed sewer thus has a radius 1 foot shorter than that of the old sewer and of the present invert, and the roof and invert are connected by vertical side walls, as shown in the cross section.



SEWER ARCH REINFORCED FROM INTERIOR

For the execution of this portion of the work, the sewer has been entered at the existing Tompkins avenue manhole, a horizontal working platform built 2 or 3 feet above the invert and clear of the sewer flow, and on it movable timber bents have been wedged up against the old cracked brick arch roof to support it when weakened by the cutting away of nearly half the thickness at each skewback alternately. All brickwork is drilled with jackhammers, cut out carefully, and the reinforcement placed in short sections first on one side of the sewer and then on the other side. As the work advances the arch timbering will be carefully replaced by heavily braced wooden forms in sections 10 feet long and the concrete will be filled in solid and brought to bear by grouting against the intrados of the old brickwork, thus giving it full support. After the concrete is sufficiently set the forms will be advanced to the next section without taking down, it will be concreted in the same manner, and so on, the concrete following closely the cutting of the skewback recesses. It is expected that when under full headway this work with a force of about seven men will be advanced at the rate of about 30 feet of completed tunnel arch per week.

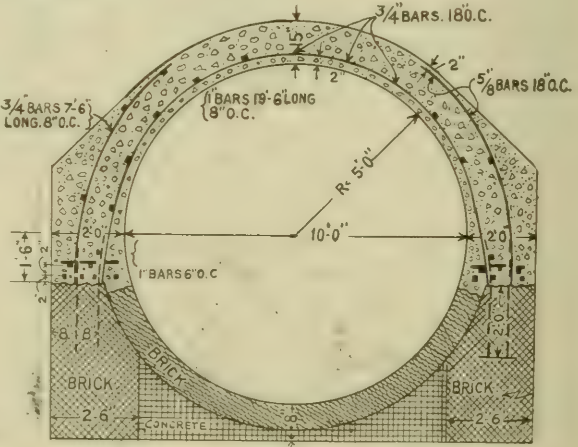
OPEN CUT WORK

For a distance of about 2,300 feet from Lewis avenue the old brick arch will be entirely removed and replaced by a reinforced concrete arch 15 inches thick, resting on the old side walls and invert 18 inches below the springing line. This reconstruction is done entirely in an open cut averaging about 25 feet deep from the surface of the street to the top of the arch and commanded by a Lidgerwood cableway of 400 feet span installed on the center line of the street directly over the sewer.

The head tower of the cableway is a timber structure mounted on four wheels and is advanced when necessary on a temporary broad-gauge track laid for the purpose as required. The tail tower consists of a shear frame that is lowered to the ground and moved bodily to the new position and re-erected when the cableway is shifted. The anchorages for the main cable consist of three 12 x 12-inch horizontal transverse timbers 12 feet long, engaging 12-foot vertical timbers in a pit excavated in the middle of the street and backfilled.

Holes 1½ inches in diameter and about 12 inches apart are made in two longitudinal lines about 9½ feet each side of the center line of the sewer, by a jackhammer drill operated by compressed air, to limit the size of the sewer trench. The earth is excavated at the working face of the trench so as to undermine the concrete base of the asphalt pavement and the latter is broken off in large chunks by sledging and is removed in the 1-yard steel buckets operated by the cableway. Excavation under the pavement is made by pick and shovel, and the sandy soil is removed in the same way and dumped directly in motor trucks, operated by the Hagerty Company, that haul it about 5 miles to the spoil banks.

After the removal of the pavement the excavation is commenced on each side of the sewer with a trench about 18 inches wide and 2 feet deep to receive the sheet piling. Rectangular frames consisting of two 10 x 12-inch rangers about 16 feet long and two 10 x 10-inch transverse struts are fastened together with scabs and put in horizontal position on the surface of the ground, the rear ends of the rangers being spliced to the forward ends of the last rangers set in the sheeted part of the trench.



SEWER ARCH REBUILT IN OPEN TRENCH

The rangers are aligned in position by blocks wedging them 2 inches away from the asphalt pavement so as to leave clearance between it and the rangers to receive the 2 x 10-inch sheeting planks 18 feet long adzed to a knife edge at the bottom, that are set in position by men working on outside scaffolds about 7 feet high.

After a group of 10 or 15 sheet pile units have been thus assembled they are successively driven a foot or two by a McKiernan-Terry steam hammer operated by compressed air, one hammer on each side of the trench working together and going back and forth from end to end of the group of sheet piles driving them a foot or two at a time as the excavation progresses until they are driven down full length.

After the sheeting is started in the shallow trenches on the surface of the excavation the dumpling is excavated between the trenches and the full width of the trench is excavated to a depth of about 15 or 16 feet, additional rangers and cross braces being set from 5 to 3 feet apart vertically as the excavation progresses.

When the excavation reaches within 2 or 3 feet of the bottom of the sheeting, a second tier of 10 x 2-inch sheet piles 16 feet long is started against the inner face of the lower rangers and driven like the other as the excavation progresses, eventually penetrating the full length and reaching down below the undisturbed old sewer.

When the old sewer arch is exposed it is carefully broken away in small pieces down to springing line, the debris falling on the wooden working platform which is built in advance about 3 feet above the center of the invert to permit the normal flow of the sewer underneath and to prevent any injuries or obstructions to the invert from the falling materials.

After the removal of the old arch and the preparation of the skewback surfaces and the side walls, wooden arch centers in sections about 20 feet long are supported from the invert, outside ribs are set, and the lower pieces of lagging are placed, reinforcement bars are assembled and wired in position, supported the proper distance above the arch forms by small concrete blocks, and the arch is concreted at the rate of one 20-foot section in about 4 hours, the weekly advance varying from 30 to 50 feet.

Concrete is mixed in one Foote and one Ransome two-bag machines moved along from time to time in the street adjacent to the excavation and supplied by wheelbarrows with stone, sand and cement delivered by trucks and stored in small piles on the surface of the street alongside the trench. The cement bags are placed on slightly elevated platforms and covered with tarpaulins to protect them from rain.

The work is executed between temporary timber bulkheads from 150 to 200 feet apart which are thoroughly braced to retain the sand from caving into the trench. At one end of the bulkhead section the excavation is progressing and the sand, shoveled into buckets, is being hoisted from the trench, transported by the cableway and dumped over the finished arch to backfill the trench by one continuous operation. The backfill is kept saturated with water from a hose to thoroughly compact it. The excess material not required for backfill is removed in Pierce-Arrow motor trucks. The Lidgerwood cableway hoists are operated by electricity, as are also the concrete mixers and the Sullivan air compressor.

The work, which was designed under the direction of Arthur J. Griffin, chief engineer of the Bureau of Sewers, Borough of Brooklyn, is being executed at a contract price of $485,000 by Booth & Flynn, Limited, under the direction of Morgan Bateman, superintendent. The average force employed is about 180 men, who receive from $5 to $7 per day. According to the terms of the contract the work is to be completed in 175 working days and is now being advanced at a rate equal to that of the required schedule.

Activated Sludge Experiments in England

Conducted at Stoke-on-Trent during past two years, dealing with waste water from potteries.

During the past two years experiments with the activated sludge system have been conducted at the Tunstall sewage works of the corporation of Stoke-on-Trent, England. The results are given in a report made by W. H. Makepeace, borough sewage engineer, the following abstract of which appears in "Municipal Engineering and the Sanitary Record," London:

The sewage of this district is heavily charged with trade waste from the potteries, known as "slip," and the particular object of the experiments was to ascertain whether such sewage could be successfully treated by the activated sludge process. The Tunstall works were selected because the sewage was organically stronger and contained a much larger percentage of trade wastes than at the other outfall works of the corporation.

The existing works were altered to adapt them to the activated sludge process and provided (a) a detritus tank 9 feet by 21 feet, having an average depth of 5 feet 6 inches and containing 6,700 gallons, (b) an aeration tank 75 feet by 42 feet 9 inches, with semi-circular ends and average depth of 7 feet 9 inches. Its capacity was 156,875 gallons, and the superficial water area 418 square yards, (c) a sedimentation tank 25 feet diameter and average depth of 13 feet 10½ inches, with capacity of 42,500 gallons, and having a downward flow inlet and sludge scraper. A duplicate tank, doubling the capacity, was, however, put into commission at a later date. The aerating tank was divided into ten bays by division walls with submerged portholes to permit the flow of the sewage through each bay in series. The floor of the inlet bay was formed on the ridge and furrow principle with diffusion plates across the full width of the bay at the bottom of each furrow. The other bays were divided lengthwise into three sections by baffle boards with a row of diffusers on the upstream side of each; the floors had a slight fall between each baffle in the direction of the flow. The air was supplied by an Ingersoll-Rand compressor having a capacity of 203 cubic feet per minute when working at 10-pound pressure, but the air pressure used was 4 pounds.

Difficulty was at first experienced in getting the sludge built up to a satisfactory condition, and it was found that septic sludge was being formed at intervals throughout the aeration tank, particularly in front of each row of diffusers. There was also trouble in maintaining a regular and continuous supply of air, due partly to engine and compressor troubles. Investigation showed that some of the trouble was caused by an excess of "slip" in the aeration tank, and as this has a very high specific gravity—2.5—the air supply then available was not sufficient to keep it in circulation, and it settled in places to a depth of 3 feet. Many of the diffusers were found to be choked, and trouble was caused by short-circuiting through several small openings which had been left in the division walls at the time they were built in order to facilitate emptying when necessary. The amount of "slip" was reduced by passing the detritus tank effluent through an additional grit chamber; the holes in the division walls were blocked up, the diffusers cleaned and the compressor speed slightly increased.

From the time these alterations were completed the results steadily improved until the necessary quantity and right quality of sludge was built up. This occurred in July, 1919, and since that date a most satisfactory effluent has been consistently produced. During the first two months of these initial experiments the plant was worked on the continuous flow system, but subsequently the fill and draw method was adopted.

INFORMATION OBTAINED FROM THE EXPERIMENTS

After a satisfactory effluent had been obtained, the tanks were worked on the continuous flow method at the rate of 120,000 gallons per 24 hours, which was increased after a few weeks to the rate of 300,000 gallons per day and an effluent of consistent good quality was obtained. The remarkable feature of this was the high nitrate figure produced, and the thoroughly stable character of the effluent has always been satisfactory; the reduction of the bacteria content amounts to 98 per cent, and the dissolved oxygen test shows 0.33 parts per 100,000 compared with the Royal Commission limit of 2 parts. Careful observation was made of the sludge returned from the settlement tank to the re-aeration tank, and it was found, after three hours' settlement, to be 70 per cent of the total volume returned.

The average analysis of the activated sludge in parts per 100, or as a percentage, was: Mineral matter, 49.2; organic matter, 50.8; nitrogen, 4.5; grease, 2.75.

Experiments were made with percentages of sludge in the aeration tank varying from 25 to 45 to ascertain whether it was practicable to carry a reserve of activated sludge in a tank normally dealing with dry weather flow so as to provide the additional sludge necessary to comply with the Ministry of Health's requirements for treating the varying rate of flow of sewage, viz., from one to three times, in stand-by tanks. It was found that an excess quantity of sludge could be successfully maintained by a dry weather flow, and that if stand-by tanks were provided and mechanical means arranged for rapidly discharging the surplus sludge from the dry weather flow tanks, varying rates up to three times the dry weather flow can be successfully treated. Throughout the experiments the flow dealt with was not constant, but varied exactly in proportion to the flow from the sewers.

Good results were obtained with settlement tanks of half the capacity of the aerating tanks, but Mr. Makepeace is of opinion that they would have been better with pyramidical bottoms.

The activated sludge showed an increase of nitrogen content of 346 per cent over ordinary sludge, which brings its utilization for fertilizing purposes within the range of a commercial proposition. The most successful method of sludge treatment was found to be evaporation by utilizing waste heat from an oil engine exhaust pipe.

The plant has intentionally been satisfactorily subjected to all sorts of abuse which it would be likely to meet in everyday practice. It was found that sewage could be run through the tanks for three or four hours while the air supply was discontinued, without serious effect on the effluent. Again, the compressor and the inflowing sewage was stopped for periods of from three to ten hours in twenty-four, and the efficiency was unimpaired when the flow was re-started.

The quantity of air was varied from 1.108 to .624 cubic feet per gallon, without any effect except to reduce the velocity through the aeration tank from about 2.5 feet per second to 1.5 feet. Below this rate settlement on the bottom commenced.

CONCLUSIONS DRAWN FROM EXPERIMENTS

As a result of the experiments, Mr. Makepeace considers that the system is reliable when once established, and is not likely to be interfered with by the trade wastes of the potteries. The system is considerably less costly to construct than ordinary bacterial methods, and its maintenance would be less than that of their existing plants. It can often be applied without a pumping scheme. The works can be controlled by a much smaller but more skilled staff. There is no aerial nuisance under the worst conditions, while the resultant sludge is inoffensive and possesses higher fertilizing value than the sludge from existing plants. An area of bacterial beds should be constructed or suitable land provided for use in case of a possible breakdown of the activated sludge plants.

Mr. Makepeace estimates that a complete plant, partly bacterial and partly activated sludge, for a population of 50,000 with a dry weather flow of 1½ million gallons would cost £85,000 as against

£125,000 for a plant on present day bacterial lines. This includes for dealing in times of storm with three times the dry weather flow as sewage and three to six times as storm water. The maintenance charges (excluding capital charges) are estimated at £4,372 compared with £6,800 for a plant wholly bacterial.

The scheme Mr. Makepeace recommends for a new installation are: Three detritus tanks, total capacity 1/25 dry weather flow; two sedimentation tanks, total capacity 1/3 dry weather flow; two aeration tanks (sub-divided), total capacity 2/3 dry weather flow; two settlement tanks (pyramidical bottoms), total capacity 1/3 dry weather flow; bacteria beds of cubic capacity equal to 1/3 dry weather flow on basis of 70 gallons per cubic yard; two sludge storage tanks for dewatering sludge from settlement tanks before drying, total capacity 1-130 dry weather flow; and sludge beds based on 1 square yard per sixteen persons.

Water Supply of Bluefield

The chief engineer of the State Department of Health of West Virginia, E. S. Tisdale, has recently made a report upon the water supply of Bluefield, W. Va., after an investigation which had been requested by the Chamber of Commerce of that city.

The report describes the present sources of supply and comments upon their quality and quantity. There are three sources of supply, one a gravity flow from eleven springs on East River mountain which furnishes approximately 250,000 gallons a day; second, springs located at the lower end of the valley below East River mountain, about two miles from the city; and third, springs about four miles from the city on the east side of the same mountain. The third source is relied upon to furnish the main portion of the supply.

The valley in which the second source is located is a typical limestone formation filled with sink-holes, the springs being in reality the outflow of an underground stream flowing through the cavernous formation in the limestone. The water is apparently derived from both underground sources and surface drainage through sink-holes. At time of rains, muddy water appears at the springs as proof of the surface source of much of the supply. Some twelve or fifteen houses have cesspools, the contents of which finds its way into these sink-holes and thence probably to the underground stream and springs. The danger of this condition has caused the city to treat the water with chlorine, which is probably to be given credit for the failure of typhoid to make its appearance in the city. These springs furnish approximately 500,000 gallons of water a day.

The third source of supply is in reality similar to the second, being springs fed by an underground stream running in limestone caverns and fed by surface water. It is not known that there is any pollution of the underground streams forming the third source of supply, but on the other hand, it is not certain that there is not some such pollution. These supplies are treated with liquid chlorine continuously and with conscientious care and duplicate machinery for emergency purposes is maintained at each station. Water is treated at the rate of approximately 0.2 parts per million. Bacteriological analyses of the water are made monthly by the State Department of Health. Records of typhoid cases in the city for the past two years show that there had been one, two and, in two instances, three cases per month.

Mr. Tisdale recommends that all of the residences on the water-shed draining to these sink-holes be compelled to connect up to the city sewerage system or to install tight septic tanks or similar contrivances.

In addition to the objectionable feature of the quality of the water, there is grave possibility of a shortage of the supply from these springs, owing to the very rapid growth of the city. All of the water from the springs is being used to capacity and, as 90 per cent of the services are metered, it does not seem possible to diminish the consumption. He, therefore, recommends that the city not only take immediate steps to prevent the pollution of the underground supply, but that it employ an engineer to plan for increasing the volume of supply.

Citizens Oppose Municipal Water Ownership

A rather unusual condition of affairs exists in Sacramento, where the recently annexed district of Oak Park is insisting that it continue to be served by the Oak Park Water Co. rather than by the municipal water department. It seems that the water furnished by the local company is considered to be of a quality superior to that furnished by the Sacramento Water Department, and the citizens of the Oak Park district believe that the water which had been served them prior to annexation is the biggest business asset of the district. The Merchants' Club and other organizations and mass meetings have protested to the city against the contemplated purchase of the Oak Park Water Co. distribution system and the furnishing through it of water from the municipal supply. Citizens of the district claim that at the time of annexation there was an agreement made with the city of Sacramento that they would continue to receive the Oak Park water and some have even expressed their desire of again separating Oak Park from the city government of Sacramento if the city insists upon discontinuing the present supply.

No More Convict Labor on New Jersey Highways

It has been reported that the State Highway Commission of New Jersey has decided to discontinue using two road camps used by convicts who were employed in building the state highways, this action being the result of a recommendation of State Highway Engineer Wasser that convict labor on the state highways be abolished.

Asphalt Production, Refining and Storing

By HERBERT SPENCER*

Production in the Mexican field, transportation to this country, refining, storing and transporting the refined product, are described briefly. The author makes a plea for agreement on a few standard penetrations.

Practically everyone is familiar with the process required to quarry and crush stone, and most of the other materials used in the construction of pavements in general. However, little has been written on the production and refining of asphalt cement used in paving work, and the object of this paper is to describe briefly some of the features entering into the production, transportation and refining of the oil from which asphalt is made, together with some of the problems incidental to the shipping of the finished product and the handling at the asphalt plant.

As the Mexican asphalt has been extensively used in all classes of paving work throughout the eastern part of the United States, the remarks will be confined largely to this grade, although applicable to most asphalts used in paving work.

The quantity of asphalt produced from domestic oil, Mexican oil and imported Trinidad and Bermudez asphalt and in use in the United States for various purposes is shown by accompanying table:

TONS OF ASPHALT FROM VARIOUS SOURCES

	1914	1915	1916	1917	1918	1919
Domestic	36[illegible],000	665,000	69[illegible],000	702,000	530,000	600,000
Mexican	316,000	390,000	533,000	644,000	652,000	672,000
Trinidad	78,000	133,000	132,000	132,000	65,000	......
Bermudez	[illegible]	33,000	48,000	52,000	48,000	......

PRODUCTION AND TRANSPORTATION

Before the introduction of petroleum asphalt in the United States, dependence of supply was based largely upon the imported native asphalts from Trinidad and Bermudez. It is evident, however, that since the introduction of asphalts from domestic and Mexican petroleum, the demand for the native asphalts has steadily decreased. Continuation of supply from Mexican fields will largely influence the completion of the large road and street-building program upon which we are now embarked, and although conditions in Mexico are far from being settled, the field is still in operation and apparently has not been seriously affected by the large quantities of oil drawn from it since it was first opened. In some sections of the Mexican oil district, and particularly in northern Vera Cruz, disturbing infiltration of salt water has affected a horizontal plane extending over a wide area, rendering unfit for use part of the oil produced. This has meant the extinction of many of the large producing wells; but prospecting in adjacent fields indicates a steady increase in the production of the Mexican oil.

The main factors entering into the use of Mexican oil, based upon present conditions in Mexico are: (1) Price, (2) Pipe line facilities, and (3) Transportation.

The Mexican government, by its new constitution, has interpreted Article 27 to provide in a retroactive manner for nationalization of all oil lands. The export tax on the Mexican oil is so heavy that a considerable part of the value of the crude at the well is collected as taxes by the Mexican government. The construction of pipe lines from the fields to the Gulf of Mexico has facilitated the movement of the crude, and increased facilities in the way of pipe lines will materially add to the quantity which can be made available for transportation to the refineries in the United States. At the close of the war the number of tank steamers available for service in bringing Mexican oil to this country was limited. Tankers now in course of construction will be placed in this service as rapidly as possible and it is expected that this will aid in materially increasing the quantity of crude oil carried from Mexico to the United States and its reduction into asphalt for commercial use.

AN OIL TANKER LOADING OFF SHORE

Pipe lines from the wells are extended out to sea; the tank steamer picks up the buoyed end, the oil is turned on, the pressure at the well being sufficient to force the oil into the tanker.

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*C. E., Standard Oil Co. of N. J., New York City

Tankers vary in size from 60,000 barrels to 115,000 barrels capacity and make the trip from Mexico to Atlantic ports in about eight days. They are all equipped with powerful pumps, and require about forty-eight hours to load and the same time to unload. Connections are generally 8-inch suction and 10-inch discharge. In some cases the oil from the well is loaded direct to the tanker, the pressure at the well being sufficient to force the oil through the pipe lines and into the steamer. This has resulted at times in too rapid loading, as difficulty has been experienced in properly controlling the flow.

REFINING

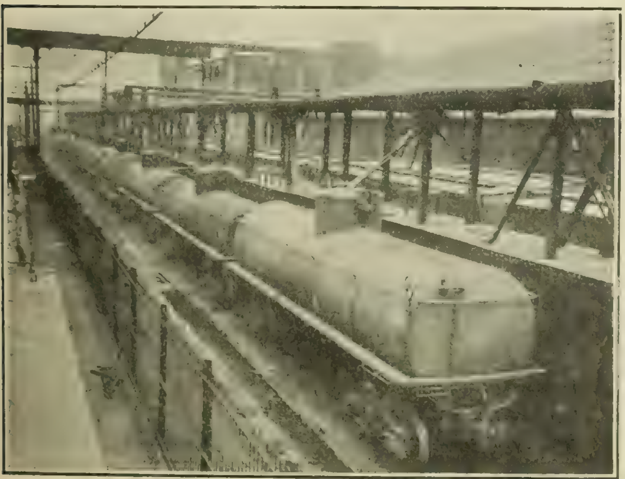
When the oil reaches the refinery, it is unloaded into storage tanks, and from there is charged to the stills, which are generally in batteries. The oil is reduced at a temperature of about 600 degrees Fahrenheit. This operation takes about sixty hours, and necessitates maintaining the correct temperature until the material reaches the penetration desired. Overheating or too rapid distillation would probably result in affecting some of the essential characteristics of an asphalt cement, such as ductility, susceptibility to climatic changes, and other features. Careful tests for penetration indicate when the material has reached the correct degree of hardness, and as the stillmen become proficient after handling large quantities of material, mistakes seldom occur. Retained samples of all material are kept for reference, and if any discrepancies in tests are reported, a comparison with the retained sample is made to determine what, if any, change has taken place since the asphalt left the refinery. Only accepted standards for testing are followed, those in common use being methods adopted by the American Society for Testing Materials, American Society of Civil Engineers, and similarly constituted bodies.

It might be well here to point out some of the difficulties that confront the refiner due to the great divergence in specifications, and particularly in reference to the variety of penetrations called for. Wallace L. Caldwell, of the Pittsburgh Testing Laboratory, estimates the causes of failure of asphalt wearing surfaces as follows:

Unsuitable mineral aggregate	30%
Improper manipulation at mixing plant	25%
Poor workmanship on street	15%
Bad weather conditions	15%
Bitumen of improper consistency	10%
Bitumen unsuitable for paving	5%
	100%

The larger cities generally lay a heavy-traffic mix and a light-traffic mix, each of which requires an asphalt of different penetration. In addition to this, an asphalt for bituminous concrete is in great demand. These three grades constitute the bulk of material for the heavier forms of asphalt construction, and no hardship is imposed on the refiner to meet these requirements. The penetrations most commonly used are 35-45 penetration, 45-55 penetration and 55-65 penetration. However, when sub-divisions of these grades are called for, it necessitates additional storage and materially affects the running of regular grades. At present refiners are asked to make asphalt of 35-40 penetration, 40-45, 45-50, 50-55, 55-60, 60-65, and 65-70, and in some cases request is made to run a material to definite penetration. The discrepancies in the test for penetration as made by different operators leave much to be desired in the practical making of this test and unnecessary grades inflict a hardship on the refiner in keeping so many stocks, when probably not more than three grades would be sufficient to meet all the variations in hardness required in an asphalt cement. The committee on asphalt of the A. S. M. I. should study this matter, and this committee, in conjunction with the Technical Advisory Committee of the Asphalt Association, should determine the penetrations best suited for the different kinds of asphalt pavement, specifying these penetrations with allowable limits instead of leaving it optional with the engineer to order any penetration he thinks best suited to his work.

After the asphalt has been reduced to the proper consistency it is pumped either to tank cars or to storage tanks. Tank cars are loaded from an overhead rack, and barrels or drums filled from storage tanks. The tank cars in use are from 6,500 to 10,000 gallons capacity, and are equipped with steam coils capable of heating the material



LOADING RACK FOR TANK CARS

Tank cars are first inspected to see that coils do not leak, and that all fittings are in place. Cars are filled to maximum capacity.

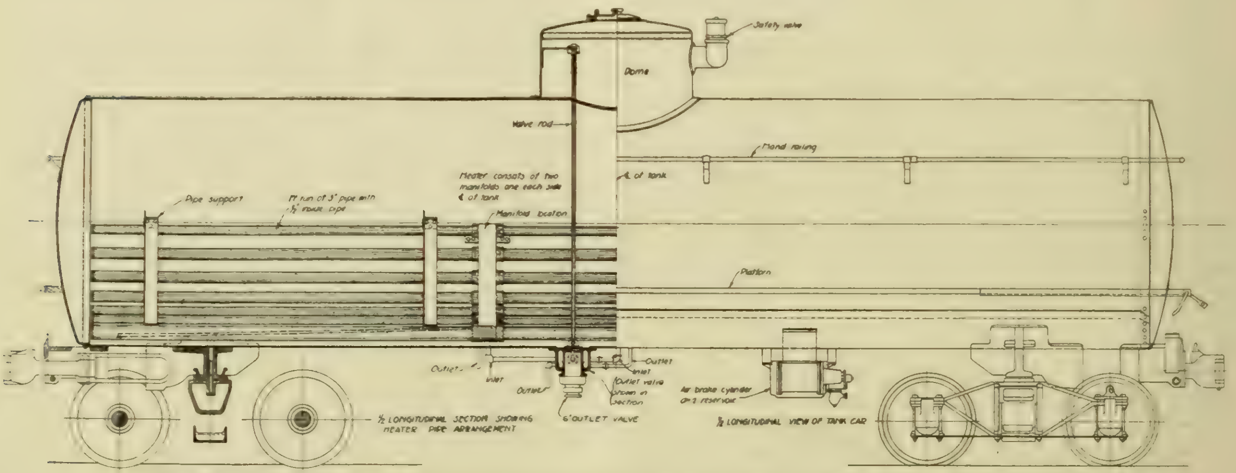
LOADING PLATFORM FOR PACKAGE SHIPMENTS

Packages are first weighed and then stenciled with the grade of asphalt, weight and date.

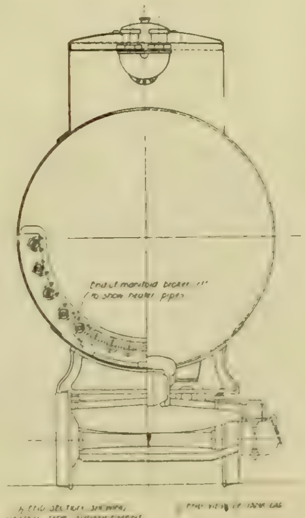
so it can be pumped in from six to ten hours. Drums are first coated with a lining of clay or similar material to keep the asphalt from sticking, and are then filled from hand nozzles. Each drum is weighed before loading, stamped with the name of the material and such other identification marks as may be necessary, and then rolled into cars for shipment.

CONTAINERS

Intimately bearing upon the economy of asphalt work is the question of containers used for shipping and storing the asphalt. This material, flowing readily on the application of heat, makes it possible to handle in bulk, thus obviating the necessity of handling in packages. When shipments of Mexican asphalt from the Atlantic and Gulf ports became heavy in 1912 and 1913 it was necessary to arrange for the transportation of this material in bulk from the refinery to destination. Fortunately the tank car had been handling asphalts for purposes other than paving for many years and required nothing new to enable it to handle the paving asphalt cements. The tank cars are equipped with steam coils, and require a minimum of fifty pounds of steam to heat sufficiently to enable them to be unloaded in from ten to twelve hours.


Safety valve
Dome
Valve rod
Hand railing
℄ of tank
Heater consists of two manifolds one each side ℄ of tank
Pipe support
17 run of 3" pipe with 1½" route pipe
Manifold location
Platform
Outlet
Inlet
Outlet
Outlet
Inlet
Outlet valve shown in section
6" OUTLET VALVE
½ LONGITUDINAL SECTION SHOWING HEATER PIPE ARRANGEMENT
Air brake cylinder and reservoir
½ LONGITUDINAL VIEW OF TANK CAR

UNION TANK CAR COMPANY'S STANDARD HEATER PIPE ASPHALT CAR WITH 1,000-GALLON TANK.


End of manifold broken off to show heater pipes
½ end section showing heater pipe arrangement

CROSS SECTION OF CAR

Due to causes entirely beyond the refiner's control, he is at times confronted with conditions that make shipments uncertain, and when a combination of adverse conditions occurs, and especially during a season when demand is far in excess of supply, it is but natural that delays should be encountered. The Mexican asphalt supply depends upon the Mexican oil supply. Delivery to the refineries depends upon ocean transportation. Delivery to the consumer depends upon railroad conditions and a mobile tank-car service. Shortage or delay in equipment, strikes or embargoes in transportation affect the delivery of material to the consumer, and the present unsettled condition of all markets has caused delays unknown under normal conditions.

(*To Be Continued*)

Some Municipal Statistics

According to the figures given in advance sheets from Crain's Directory, there are 60 cities in the United States of over 100,000 population, 60 between 50,000 and 100,000, 131 between 25,000 and 50,000, 445 between 10,000 and 25,000, 548 between 5,000 and 10,000, 844 between 3,000 and 5,000, 1,043 between 2,000 and 3,000, and 2,921 between 1,000 and 2,000. The counties in the states total 2,800.

Of the 5,359 waterworks systems in the country, 1,488 are privately owned and 41 are of mixed ownership. Of the total number, 1,066 are operated in conjunction with lighting plants. The total horsepower of waterworks pumping machinery is 1,021,482, of which 852,646 are steam, 103,216 are electric and 65,620 are internal combustion and water power.

Lumber Reports

The weekly trade barometer of the Southern Pine Association, New Orleans, reports that for the week ended November 26 orders for lumber received aggregated 41,978,402 feet and shipments, 55,716,391. These figures embraced 136 mills and showed shipments 1.87 per cent greater than the week's production and orders 23.25 per cent less than the week's production, the production itself being 38.84 per cent below capacity.

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A Government Monopoly of Power

The cities of the entire province of Ontario, Canada, are in the grip of a monopoly so far as electric power is concerned, only one city in the province, it is reported, being able to obtain current from any other source. But the monopoly is an unusual one, being a commission created by the province itself. Perhaps the nearest parallel to it in this country is the Metropolitan Water Commission of Massachusetts (in its form as originally created), which developed or acquired and sold the water supplies used by Boston and its suburbs.

But the Canadian Commission is far more comprehensive and extensive in its scope and territory than the Massachusetts commission. It has bought up eighty-four private distributing companies besides all of the companies generating power on the Canadian side of Niagara Falls, having just paid about thirty-two million dollars for its last and largest competitor. For thirteen years it has fought private competition and capital and is now victor. It generates and distributes practically all the power used north of the Great Lakes, selling current to the cities at approximately cost of delivery. Besides the generating and transmission system, it owns electric railways, operates testing and research laboratories, farms land on its rights of way, and furnishes engineering advice and assistance to municipalities relative to electric lighting and other uses of power.

There are many interesting features connected with the operation of this commission, financial, administrative and engineering. Its assets approximate seventy-five million dollars. It sells current at cost, keeping a separate account with each city of the cost of generating the current it receives, of transmitting it to the city and its share of administration expense; these costs vary from $12 to $70 per horsepower. It constructs as well as operates power plants and transmission lines over probably 50,000 square miles of territory.

A public enterprise in the United States proportionately large would be, for example, government operation of all the coal mines of the country. If this should come, let us hope that it will be conducted to as full advantage to the public as is the public ownership of hydro-electric power in Ontario.

Encouraging Labor Signs

The return of the pendulum and the ultimate equilibrium of supply and demand are never to be seriously questioned, but sometimes they are discouragingly slow.

The war prices and reconstruction period through which we have passed have afforded opportunity for predatory crimes from which no class has been free, but the strongest possible encouragement is now afforded by the signs on every hand that the crest of the wave is well past and that affairs will hasten more and more rapidly towards normal, even passing it for a long and solid era of increasing prosperity. This is true with commerce and finance, industry and production, capital and labor, and even with politics and religion.

Production and consumption are becoming more normal, profiteering in all quarters is being reduced, or punished, or threatened, and the interrupted tide of prosperous activities is rapidly gaining momentum. It will adjust itself automatically in construction matters by greatly increased public operations using the thousands of millions of dollars already available and the increasing amount of materials and transportation for the double purpose of catching up with vital improvements and for affording employment to the idle and stimulating business, at the same time that the unsettled conditions and uncertain markets delay the resumption of private and corporation work that will later revive in enormous and sustained quantities.

This adjustment has already commenced and will safely bridge the period between the great difficulties that we have passed and great opportunities that we are rapidly approaching. One of the most important indications is the changing attitude of labor. Although the rank and file do not yet, and perhaps never will, understand the reasons, they are beginning to feel that piling strike on strike, increase of pay on increase of pay, shortening the hours, reducing production and interfering with the comfort and safety of the nation has not brought them any permanent advantage. They are dissatisfied with radicals, extravagance and unrest, for they have suffered from the unnecessarily high cost of living and begin to realize that unlimited employment will not be given them when their wages are too outrageous or their actions too unreasonable. Capital may be forced to pay high wages but not to give full employment. Unjust strikes and sabotage do not receive public sympathy, and instead of demanding them, labor is rapidly turning its attention to holding a job, to giving better satisfaction, increasing production and in some cases willingly accepting smaller pay rather than none at all.

The radical element is discredited and the latest reports from labor executives indicate an encouraging change of heart in the abeyance of "direct methods" and the adoption of the more powerful and manly policy of democratic methods to secure reforms or privileges by legislative methods.

This is a long step in the right direction and there is little fear that any very undesirable legislation will result or that such legislation would be at all permanent if secured. This brings it into the public educational field which, above all things, is to be desired for the general good.

It has been announced that the program of the Executive Council of Organized Labor for the coming year includes strenuous efforts to secure the repeal of existing laws and to prevent the enactment of proposed laws requiring compulsory arbitration of industrial disputes; opposition to laws restricting the right of workers to quit work, otherwise to strike; legislation for immigration restriction so drastic as to practically prohibit immigration; and Americanization of aliens.

One of the most encouraging features of this platform is the plank for the Americanization of aliens, in which all classes could and should heartily join.

To Save High Bridge

The recommendation of Grover A. Whalen, commissioner of plants and structures of New York City, that High Bridge be removed has called forth protest from a number of sources, including practically all of the engineering bodies of the district. One of the latest of these to enter protest is the New York chapter of the American Association of Engineers. In its letter of protest it says that "High Bridge is not only a structure of esthetic value and a memorial of an important engineering project, namely, the bringing to New York of the first supply of water adequate for a metropolitan city, but also is of utility as a highway and of still further use as an aqueduct in case of emergency." It declares that an expenditure of $750,000 for necessary repairs to the bridge, the amount named by Commissioner Whalen, would be justified. Hearings on this question by the Board of Estimate have been adjourned to January 3.

George S. Rice

George S. Rice, for seven years chief engineer of the Rapid Transit Board of New York, died December 7 at his home in Montclair, N. J., after an illness of several months.

Mr. Rice served recently as division engineer of the Public Service Commission. Original studies of the New York subway project were made by him between 1892 and 1900. In 1904 he became chief engineer of the New York Rapid Transit Commission, remaining in that position under its successor, the Rapid Transit Board.

He was born in Boston in 1849, and was graduated from the engineering department of Harvard in 1870.

Maintaining Distribution System in St. Louis

In the St. Louis waterworks there were, at the end of the latest fiscal year, 12,877 stop valves and 11,944 fire hydrants. Each fire hydrant was cleaned, oiled and packed in place an average of nearly three times, or 34,245 in all. Cleaning, oiling and packing of stop valves was performed 26,557 times, or more than twice for each valve.

The total amount of pipe in service was 1,013.4 miles, of which 611.3 miles was 6-inch and the next largest amount was 12-inch. There were only 2.4 miles of 4-inch, and 15.8 miles of 3-inch. On this system there were discovered during the year 1,057 leaks, of which 34 were breaks, 60 broken fire hydrants, 351 leaking fire hydrants, 209 leaking sprinkling hydrants, 30 leaking sleeves, 181 blown joints, 133 leaking taps and ferrules and 59 leaking valves.

During the year the city continued the cleaning of water mains of all sizes from 6-inch to 20-inch, inclusive. About 60 miles of mains were cleaned and there was removed from them 568.67 tons of incrustation, or 16,605 cubic feet. The amount of incrustation per lineal foot of pipe varied from 1.1 pound up to 6.75 pounds, the latter being in a 10-inch pipe. This work was done by the National Water Main Cleaning Co., which has completed a contract for cleaning 92 miles of the city's mains. The average age of the mains cleaned was 29 years. The average efficiency before cleaning was 49 per cent, based on Pitometer tests, and the average efficiency immediately after cleaning was 95 per cent. The efficiency is found to fall off to some extent after cleaning, due, as nearly as can be determined at present, to the scratching of the interior coating and the subsequent rust formed on these scratches. Data on the rate of deterioration are being gathered by monthly tests on several representative lines and by random tests of lines cleaned on previous contracts.

Public Work for Unemployed

At a meeting in Jackson, Mich., December 9, of managers', manufacturers' and employers' associations of a dozen industrial cities of the state resolutions were adopted calling upon the governor and mayors to at once start work on contemplated public improvements in an effort to furnish relief, instead of awaiting anticipated reductions in material costs.

The conferees estimated that $150,000,000 was now available for such work. It was shown that of a total of 495,000 men normally employed 312,000 are now at work. The cities represented included Detroit, Battle Creek, Jackson, Saginaw, Muskegon, Flint, Pontiac, Kalamazoo, Lansing and Grand Rapids.

Delaware State Highway Testing Department

Well equipped laboratory at headquarters for continual testing of materials and of concrete specimens made there and in the field. Research work and experimental investigations also conducted there.

The small size of Delaware allows the control of the quality of materials from a central point, which is located at Dover, and this eliminates many of the usual field tests.

The laboratory of the Division of Tests and Investigations occupies the basement of the State Armory, in which the State Highway Department offices are located. It includes all the equipment necessary for making routine and check tests of road materials, including asphalts, tars, sand, stone, cement, etc., and is equipped to carry on certain kinds of research work. All tests are made in accordance with the standards of the American Society for Testing Materials.

All cement is sampled at the mill prior to shipment, the tests being made at this time in order that no work will be held up due to untested cement not being allowed for use. Samples of cement are also taken periodically from cars received, and tested in order to check the results obtained in the cement district.

All sand is tested at stated periods. Local sand pits are sampled daily in order that any non-uniformity may be determined. Sources of supply which have been operated for some time and have shown a uniform quality are generally not tested more than twice weekly unless a question arises.

All stone is tested at stated intervals, depending upon the source of supply. Due to the fact that this state receives its stone supply (crushed trap rock) from permanent quarries, very little trouble is encountered in securing stone above the requirements.

All asphalts and tars are tested at Dover, samples being taken of each shipment and forwarded to the laboratory.

In addition to the cement, sand, stone and water being tested separately for all concrete road work, the inspector on each contract makes two test specimens each day from the concrete being laid.

One of the specimens is a 6 x 12-inch cylinder, used for compression tests, and the other is an 8 x 8 x 5-inch block used for making wear tests by means of the Talbot-Jones rattler, which has been added recently to the laboratory equipment.

These road test specimens are cured under the same conditions as the roadway and removed to the laboratory for test. The test results are compared with laboratory specimens, made from the same materials used on each of the different contracts as standard. This program furnishes a check on all phases of the work and assists in locating any trouble occuring which would be detected from low strength tests of the road specimens.

In order to follow the uniformity and to compare the quality of all materials used in concrete road construction, sample boxes are sent to each contract to be filled and returned to the laboratory upon the first day of each month. These 12 x 12 x 12-inch boxes are divided into compartments in which are placed the samples of sand, stone, cement and water being used at that time.

The sample box is arranged so that no inconvenience is experienced in packing the samples, as bags are included in the box for sand and cement and a bottle is furnished for the water sample. This box is secured with a padlock and sent to the laboratory.

LABORATORY EQUIPMENT

For asphalt testing the New York Testing Laboratory penetrometer, the Smith ductility and the Dulin Rotarex are among the larger pieces of apparatus used.

The Tyler standard sieves are used with the Tyler Ro-tap machine for routine sieve tests.

For stone the Deval abrasion machine is used and the strength of the concrete is tested by means of a 100,000-pound Olsen Universal testing machine.

The Standard brick rattler is used for making brick tests and the Talbot-Jones rattler for making wear tests on concrete specimens.

In addition to this equipment, a flow test table has been installed for experimental purposes. This table is used in conjunction with the slump test for determining the consistency of concrete mixtures. It was originated by G. M. Williams of the Bureau of Standards and he has been very successful in his results with it. It consists of a flat-top table and a cam arrangement so that a freshly molded specimen of concrete may be placed upon it and alternately raised and dropped, thereby being subjected to a bumping effect to cause the concrete to flow out from the center of the table. The flow is determined by measuring the perimeter of the mass after being given a certain number of jolts at a given amount of drop.

When material is received for experimental purposes it is dried in large bins and then stored in other bins until used. All specimens are hand mixed upon a mixing board 4 feet square, lined with galvanized iron, sloped towards the center in order to prevent any water being lost. After removing the molds, the specimens are stored in curing pits where the cylinders are buried in sand which is kept damp for a period depending upon the nature of the test. In capping the cylinders, a layer of neat cement paste is finished on the top and bottom of each specimen. They are then placed in the testing machine with a piece of beaver board on each end, and broken. In case a road specimen comes in with a very rough surface, it is smoothed by means of emery on a flat steel plate before being capped.

Research is conducted in the laboratory which is mostly related to the problems encountered in the work as done under conditions in Delaware, although quite a little experimenting has been done with hydrated lime in concrete, the movement of concrete slabs, concrete hardeners, and other subjects of interest and value to the state. The advantages of a sand-cement mixture in replacing the 1-2-4 concrete used at present in this state are about to be determined, in hopes that a suitable wearing course may be obtained at a cost less than the present prices.

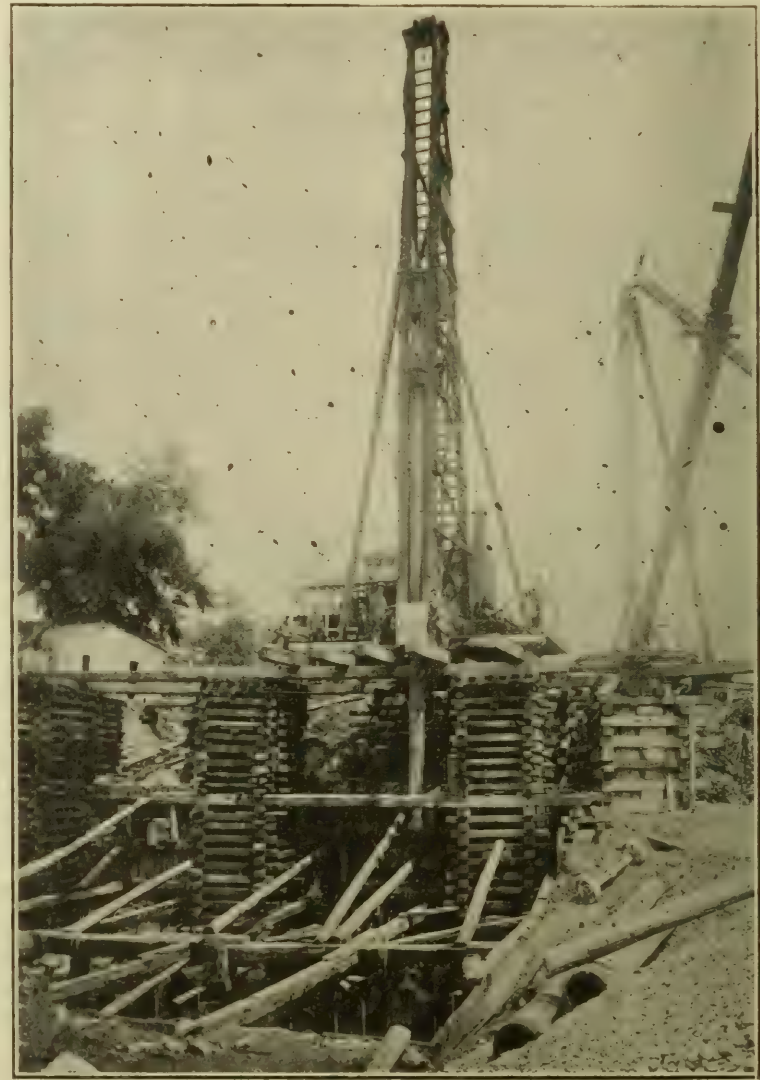
It is estimated that in 1921 automobile licenses in Minnesota will yield $5,400,000 to be spent for the building of good roads and apportioned to counties in proportion to the direct sum derived from licenses in each county. In addition it is expected that more than $300,000 will be derived from the dealers' licenses, chauffeur's licenses and other special fees.

Tate county, Mississippi, has suspended any further road improvements because of lack of funds. Last fall the county sold $300,000 of road bonds, with the understanding that the State Highway Commission would add $150,000. This offer was withdrawn later, and the county did not get the expected assistance from the state.

Pile Foundation for Bridge Approaches

40-ton equipment installed on cribbing 30 feet high, and on top of cofferdam at Western Gateway bridge over Mohawk river.

The great Western Gateway bridge between Schenectady and Scotia, N. Y., crosses the Mohawk river where the ground is soft and the heavy approaches are carried on concrete pedestal pile foundations. The general contracts were awarded to Dubois, Bennett & Son of Schenectady, who let the contract for the concrete piles for the abutments and approaches to the MacArthur Concrete Pile and Foundation Company, New York, who drove 706 patent pedestal concrete piles 16 inches



40-TON PILE DRIVER EQUIPMENT OPERATED ON CRIBWORK 30 FEET HIGH in diameter and with an average length of 23 feet with their regular 40-ton equipment consisting of a wooden tower 60 feet high, a number one Vulcan steam hammer, a standard steel mandril and casing 42 feet long, and a 2-drum, 2-spool Lidgerwood hoisting engine operated by a 40 h. p. steam boiler.

WORKING IN DEEP COFFERDAM AND SHIFTING PLANT

On the Schenectady side, the general contractor built a 45 x 60-foot cofferdam for the abutment, extending close to the foot of the river bank 30 feet high. In this cofferdam with the bottom 10 feet below water level, there were driven 50 23-foot foundation piles installed from the top of the cofferdam 15 feet above the ground level.

After completing this part of the driving, the equipment was transferred to the top of the bank at an elevation 25 feet higher, or about 30 feet above water level. As derricks were not available for lifting the plant, it was lowered to skids at the foot of the bank, and the boiler was detached and hauled to the top, where it was immediately put in service and supplied steam to the hoisting engine that in turn pulled the remainder of the equipment up the inclined skids to the top of the bank, where it was assembled, the tower raised, and pile driving resumed.

It was at first expected that the main abutment would be concreted and ready to support the pile driver for the installation of piles close to the cofferdam at the foot of the bank. This, however, was not the case, and eventually the tops of some of the concrete piles already driven in the cofferdam were cut square and on them was built timber cribbing 30 feet high, surmounted by tracks on which the pile-driver was operated with such care that the work was rapidly accomplished without accident of any kind.

COMPENSATED SETTLEMENT

After the completion of the work on the Schenectady side of the river, the equipment was dismantled, transported to the Scotia side on trucks, installed over the cofferdam and operated there at a uniform level for the entire work. The ground was too soft to support the equipment, and in order to compensate for the settlement, jackscrews were placed between the cribbing and the main caps on which the runs were laid, and men constantly operating them maintained the pile-driver at the required height during the whole operation.

The work was executed by an average force of 22 men under the direction of E. M. Mahoney, field superintendent, while the entire job was under the personal supervision of F. L. Jenkins, general superintendent. The best record made was 23 piles 23 feet long in one eight-hour shift.

The cribbing in the cofferdam on the Schenectady side of the river consisted of independent cribs about 6 feet square, made with railroad ties and located in alternate pockets between the heavy cross braces in the cofferdam. The slender, tall crib towers were made very much stiffer by building into them, about halfway between the top and bottom, a course of 8 x 8-inch timbers 30 feet long, that passed through a pair of cribs and, when held in place by the heavy weight above, braced them firmly together.

Heavy wooden stringers laid on the tops of the cribs supported a set of five cross timbers on which three long transverse rollers were operated to move the pile-driver back and forth while it was adjusted transversely in the usual manner by pushing it along on the rollers.

In constructing this foundation, the concrete was subjected to the heavy impact required in the formation of the pedestals at the feet of the piles, and the displacement of the adjacent soil, as well as to the final continued static pressure produced by pushing directly against the top of the pile shaft and developing reaction corresponding to the great friction caused by withdrawing the temporary pile casing.

This treatment is obviously beneficial to the fresh concrete and results in an increased density and strength that is disclosed by the results of comparative tests of specimens of concrete taken from the completed sub-structure and superstructure.

These tests were impartially made under the strict supervision and rigid requirements of the state engineer's office and their average shows that the pile concrete was more than 21 per cent stronger than the superstructure concrete of the same proportions and specifications, even though the latter was slightly older when tested and had the advantage of being placed in an accessible position favorable for inspection and careful treatment.

COMPARATIVE TESTS OF PILE AND WALL CONCRETE

Testing Laboratory, State Engineer's Department,
Albany, N. Y.

August 18, 1920.

Mr. E. D. Hendricks, Division Engineer,
Albany, N. Y.

Dear Sir:

The following are the results of compression tests made on four 6 x 12-inch cylinders made of concrete taken from work on the contract for abutments of the Schenectady-Scotia bridge.

These cylinders were received at the laboratory on August 17 and were tested on August 18.

Cyl. No.	Date Made	Taken from	Age at test	Total lbs	Compressive strength Per Sq. inch lbs
*3	June 25	5th Sec. No. Wall	54 days	51,000	1810
*4	" 25	" "	54 "	50,500	1800
‡5	" 28	Pile No. 27	51 "	66,500	2350
‡6	" 28	Pile No. 27	51 "	57,000	2020

I would call attention to the differences in strength between the concrete in the piles and in the walls. We know that the concrete in the piles is mixed drier than that in the walls and the results secured indicate a better concrete.

Very truly yours,
RUSSELL S. GREENMAN,
Sen. Asst. Engineer in Charge of Tests.

*Concrete. 1:2½:5. Mix, placed by DuBois Bennett & Son.

‡Concrete. 1:2½:5. Mix, placed by MacArthur, C. P. & F. Co.

The abolition of the Department of Interior and creation of two new departments, one of public works and one of public welfare, will be proposed in a bill prepared by Senator McCormick of Illinois, which will also abolish the Board of Mediation and transfer its functions to the Department of Labor.

Immigration Notes

In spite of the fact that the transportation charges for immigrants have been raised from about $15 to $120, the number of Europeans flocking to this country is increasing with unexpected rapidity and conservatives view with apprehension the possibilities of an unprecedented inundation that, while it brings many sorely needed workers is also badly infested with defectives, undesirables, criminals and paupers, besides the vicious radical element whose purpose is treasonable.

Incoming vessels are more and more crowded and the estimates of unrestricted immigration within the last few years have risen from 5 to 10 and 15 millions and even to 25 millions, which are doubtless impossible but still indicate the magnitude and direction of the tide.

Strong efforts are being made to secure legislation to restrict immigration, some bills calling for universal exclusion and some keeping to limited numbers or classes, or restricted to a definite time, or to make the entrance requirements so difficult as to exclude a great proportion of the applicants. Suitable entrance requirements, calculated to encourage honest, thrifty workers and make them all loyal citizens in combination with rigid physical, mental and political inspection should be provided.

It is pointed out that, as the present special war-time passport regulations automatically expire March 4, immigration will then become much more unrestricted and it is necessary that emergency laws be passed in the meantime. Several bills have been prepared or are in preparation to present to Congress and it is probable that prompt action will be taken on them.

The American Federation of Labor advocates the complete suspension of immigration for two years, and Senator King of Utah proposes to prohibit immigration entirely for six months, while Congress is revising the law, and Chairman Johnson of the House Committee on Immigration and Naturalization now in session, favors temporary suspension of immigration during the legislative investigation.

Senator Sterling of South Dakota expects to introduce to Congress a bill creating a Federal Immigration Board to deal with all questions relating to immigration, including the right to decide the number of immigrants to be admitted.

Ole Hansen, former mayor of Seattle, has just returned from a study of economic conditions in England, France, Poland, Sweden, Germany and Denmark, and is convinced that it is necessary to greatly increase our barriers against immigration for several years.

Government data indicate that at least 12,000,000 people in Europe wish to immigrate to the United States and that the number actually arriving will soon equal the maximum record for the year ending June, 1914, when nearly 1,250,000 immigrants arrived.

Recent arrivals at Ellis Island include many that are sick, defective or otherwise undesirable, besides great numbers that are entirely destitute or have less than $10 in cash for their subsistence, to say nothing of paying their fares to their final destination.

In Canada, where immigrants of the right character are welcome and encouraged, they are required to possess a minimum sum of $250, plus their transportation, a regulation which seems to work satisfactorily there.

Anthony Caminetti, Commissioner General of Immigration, has sailed for a visit to Poland, Germany, Italy and the Balkans to investigate there immigration conditions so that he can advise Congress next term regarding legislation to alleviate hardships to immigrants losing their homes and purchasing transportation to this country only to find themselves inadmissible on arrival.

During the last fiscal year only about 10 per cent of the immigrants arriving from Europe settled in the Pacific Coast states, California, Washington and Oregon. Of these nearly two-thirds settled in California. Most of them arrived through the port of New York.

Foreign correspondents report that every seacoast city and town in the west and south of Europe is crowded with emigrants and that at least 5,000,000 Germans and Austrians are packed and ready to come to the United States as soon as possible. On one day the Polish foreign office received 311,000 applications for passports, according to reports.

An Italian syndicate with a capital of $700,000 has been organized in Rome to promote emigration and assist Italian emigrants, a large proportion of which will come to the United States. Special schools have been established to teach the emigrants to read and write foreign languages and to train them for occupations in their new homes.

Restricting Immigration

A bill that is intended to prevent the entrance into this country of excessive numbers of undesirable immigrants during the immediate future and to restrict those that do arrive to the most desirable class is now being prepared by a committee of the House of Representatives, Albert Johnson, chairman.

If this were all, the bill might be a desirable one, but it is so drastic as to exclude not only the undesirables, but almost all the desirables.

The bill will provide that immigrants can be admitted to the United States only after application in their behalf has been made by relatives who are citizens of the United States. Persons who had not been naturalized would not be permitted to bring in relatives under any circumstances.

These applications would have to guarantee that the immigrant was in good health, of good character and possessed of the proper financial and educational requirements for admission. If the application should be approved, a copy of it would be sent to the United States consul nearest the home of the immigrant, who in turn would appear at the consulate to have his passports vised.

The New Hampshire Commissioner of Labor will submit to the next session of the State Legislature a bill to amend the Workmen's Compensation Law so that injured workmen shall receive 66 2-3 per cent of weekly wage in case of injury, with maximum lump sum of $5,000 if permanently injured.

To Improve Newark Bay Area

The Chamber of Commerce of Newark, N. J., on November 18, adopted resolutions endorsing a plan for the expenditure of $1,025,000 by the city for deepening the channel in Newark Bay and filling in lands along the shore so as to give a 30-foot channel with a width of 300 feet from deep water in Kill van Kull to the mouth of Port Newark canal; also deepening and widening a similar channel in the canal to the government warehouses and making other improvements in the vicinity, including the use of the excavated material for filling in city lands covering an area of perhaps 100 acres. It is proposed that the city issue bonds to meet the cost of this improvement.

The Detroit United Railways have entered suit to prevent the city from acquiring municipal ownership of the street railway line.

Cleveland Street Car Fares Increased

Cleveland street cars, operating under the Taylor plan, are now receiving the maximum fares, which are 6 cents straight or nine tickets for 50 cents and 1 cent for transfer, which is only permitted when the interest fund of the Cleveland Railway Committee drops below $300,000. When it is above this sum the fare automatically drops.

Panama Canal Self-Supporting

Notwithstanding a recent change in the rules of measurement which reduced the toll income, the total receipts for the Panama canal for the fiscal year have exceeded the total operating expenses by $2,387,599, an amount which does not take into account the interest on the investment, which amounts to $367,151.66. The total expense during last year was $6,548,272, the receipts being $8,935,871.

Harbor and Waterway Improvement for 1921

It is estimated by Major-General Lansing H. Beach, chief of the army engineers, that work on the harbor and waterways improvements by the federal government during 1921 will require something over $78,000,000, this including about $11,000,000 for continuing contracts now under way. The largest item is $16,190,000 for the Mississippi river from its mouth to Minneapolis. For New York harbor and adjacent waters, $5,800,000 is asked, and $5,585,000 for the Ohio river, $3,857,000 for the Delaware river, $2,500,000 for the Delaware and Chesapeake inland waterway, and $2,115,000 for the Missouri river.

San Francisco Water Front Extension

The chief engineer of the Board of State Harbor Commissioners of California, Frank G. White, states in a recent report that the water front of San Francisco has been developed practically to its capacity from the foot of Taylor street to the foot of Channel street. The logical location for further development is in the vicinity of Islais creek. The state has recently acquired, at a cost of about $850,000, sixty-three blocks of submerged land here which together with India Basin which adjoins the property, makes available an area of 280 acres of state-owned land capable of development. Five blocks of this have been reclaimed and wharves have been built along about half of the reclaimed area.

It is the purpose of the state board to develop on this property a water front terminal and industrial district. The land will be filled practically to the present water-front line and piers extended to the pierhead line. Wharf sheds, warehouses, railroad tracks and other structures will be provided. A depth of at least 34 feet of water at low tide will be provided for large ocean-going vessels. This will necessitate dredging the Islais creek channel, the slips between the piers and the areas north and south of the channel.

The increasing needs of shipping will necessitate this development in the near future. It is the purpose to make this development progressive, ultimately providing berths for 49 steamships each 500 feet long and for 6 vessels 300 feet long. The solid fill will be 1,060 feet wide and from 1,600 to 3,000 feet long, while the piers which extend to the pierhead line will be 330 feet wide and 1,100 feet long.

$5,000,000 Tunnel Bond Issue

The Bridge and Tunnel Commission in charge of the Hudson River-New York-New Jersey vehicular tunnel and the Camden-Philadelphia bridge, has ordered an issue of $5,000,000 thirty-year 6 per cent bonds of the $28,000,000 bond issue authorized.

Ontario's Electric Power Monopoly

The Hydro-Electric Power Commission of Ontario has recently bought out the only large private owner of such power in the province and thus secured practically a monopoly, becoming the largest generating and distributing power organization in the world. By 1922 the total investment of the associated Ontario municipalities will be nearly $170,000,000, and the total capacity more than a million horsepower. Eighty-four private companies have been bought and consolidated, the only one left in the province being that of Hamilton.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

Sheeting Sewer Trenches

Wood and steel sheet piles. Driving by hand and bracing.

Sewer trenches through dry, hard or stony ground, clay or solid loam usually preserve the vertical faces long enough to permit the completion of the work without special protection to the sides. In most soils, except sand, where a trench can be excavated by power machines, the soil is likely to possess sufficient stiffness to stand up until the work is completed, or at least until sometime after the excavation has been finished so that sheeting, if any, is a simple matter.

In mud, silt, loose sand, or other unstable soil and in very wet soil, it is usually necessary to support the vertical sides of the trench as fast as the excavation is made, by means of sheeting or sheet piling and bracing. This is especially necessary in city streets or near foundations or other structures where it is essential to prevent settlement and displacement of the adjacent ground, especially where quicksand is encountered and may bleed through the cracks in the sheeting or may cause trouble by boiling up in the bottom of the trench.

In open field work if the trench is not too deep it is often permissible even in soft unstable ground, to disregard the condition of the sides of the trench and allow them to take their natural slope, excavating the material that slides in when this is cheaper, more rapid or more convenient than maintaining a narrow width at the top of the trench.

In many cases, however, it is imperative to provide some means of keeping the sides of the trench approximately vertical and preventing the displacement or settlement of the adjacent ground. If the ground is firm and solid and is not disturbed near the edges of the trench, it may stand safely until the excavation is completed, after which the vertical sides may be covered with planks held in position by longitudinal timbers called rangers, and by horizontal transverse braces engaging them; the planks may cover the entire surface of the vertical faces, or, if it is only necessary to prevent the initial movement of a firm stratum, they may perhaps cover only half the surface, with wide clearances between the separate planks. Usually the planks are placed vertical as a matter of convenience, but they can be placed horizontally if preferable. The lower ends of planks are usually adzed to a knife edge and the planks driven with mauls to penetrate a foot or two below the bottom of the trench and give them additional security.

If the soil is very loose and unstable it is necessary to sustain the sides of the trench as fast as the excavation is made or, generally, in advance of the excavation. For a small amount of work in dry ground and for moderate depth of trench, 2-inch square-edge planks from 8 to 12 inches wide and ordered to the approximate lengths required up to 16 feet, are suitable and can be driven by hand as the work progresses, keeping pace with the excavation. These planks closely aligned to form continuous walls on opposite sides of the trench will be true sheet piles and to secure proper alignment should be driven between a pair of rangers laid on surface of the ground and bolted together with fillers just wide enough to space them far enough apart for the planks to be entered.

At the beginning of operations a dozen planks, or any other convenient number, should be assembled together in vertical position between pairs of rangers on opposite sides of the trench, braced in position by stay laths if necessary, and working platforms made of planks laid on horses just adjacent to them on the outside of the trench should be provided to make scaffolds for men with heavy wooden mauls to drive the piles successively from first to last of each group, driving each pile a few inches as the excavation immediately in front of it is made, returning to the end of the line and repeating the operation again and again as the excavation is extended downward. The men in the trench should take particular pains to excavate or loosen the earth around the feet of the piles and especially to remove any stones or obstructions that may be encountered, so that the piles can be driven with minimum effort, keeping the lower ends below the surface at all times.

As the excavation advances, the lines of rangers are extended, additional groups of sheet piles are assembled and driven between them, and so on, until the first piles are driven to the bottom of the trench while others are continually added in front as the trench advances.

After the trench has been excavated to a depth of from 2 to 6 feet below the surface (according to character of ground), the inner rangers are braced apart by transverse struts usually about 10 feet apart, held in position by cleats nailed to the rangers. A second tier of rangers is laid on the bottom of the excavation, against the opposite faces of the sheet piles, and is braced in a similar manner but in longer panels, until the excavation has been carried down below the cross braces and additional braces can be inserted without too much obstructing the work underneath. Successive courses of bracing are thus added as the trench grows deeper and deeper until, according to the character of the ground and the depth, the pressure may be so great as to require braces only 2 to 3 feet apart vertically, and 5 or 6 feet apart horizontally, which is about as close as practicable, and is very expensive. If these prove inadequate for very heavy pressures the sizes of the rangers and bases may be increased, seldom or never to exceed 12 x 12 inches.

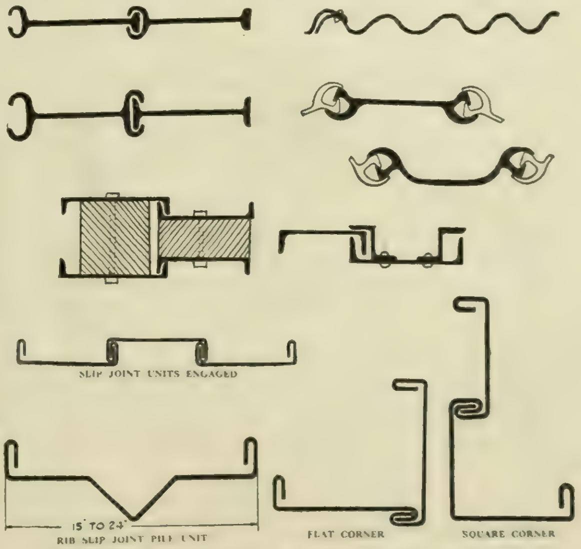
If the trench is more than about 14 or 15 feet deep it will usually be necessary to start it a foot or two wider than is required at the bottom, and when it has been excavated nearly to the bottom of the first tier of sheet piles, to start a second tier of piles parallel to the first and on the inner face of the lower ranger, driving them down as already described in short successive operations as the excavation proceeds. The advantage of the second tier of sheeting is in the shorter, cheaper and more convenient lengths of piles and on account of the facts that the friction of driving is greatly increased with the length of the pile and that all of the friction of the first tier of piles is eliminated when the second tier is commenced.

If there is so much ground water that it is necessary to exclude it by the sheet piles, care must be taken to drive them with their adjacent edges as closely as possible in contact. They are sometimes driven with tongue and groove or with splined or ship-lap joints, all of which are useful if they are successfully installed, but all of them are the weakest parts of the units, and are liable to injury and destruction in driving.

It is also difficult to keep the piles in alignment below the surface, and the joints are liable to be broken or disengaged and the piles to get out of the vertical plane, sometimes opening large gaps between them if special care is not taken with inspection and correction. In such cases the lower ends of the piles are often beveled so as to cause them to draw against the last-driven pile, and sometimes guide blocks are wedged close to their forward edges and secured between the rangers to hold them very securely while being driven. If the soil is clear and free from obstructions such as gravel, boulders, logs and portions of old structures, it is possible with care to drive the piles uniformly and in good engagement; but if serious obstructions are encountered they are likely to destroy or deflect the piles and driving at the obstructed point has to be stopped until the excavation reaches the obstruction and it can be removed, while sometimes it is necessary to drive another auxiliary group of piles to enclose the obstruction and connect with the regular line before and behind it.

Where very much ground water is encountered or the sides are very unstable it is often desirable to drive the sheet pile full length before commencing excavation. For this purpose it is always necessary to use mechanical devices, generally light hammers operated by steam or compressed air. Although drop hammers operated by a hoisting engine can be used, they are not usually as advantageous, portable or efficient. Air or steam hammers are also frequently provided on large jobs where piles are driven only as the excavation advances, one small air hammer requiring a single man to operate it, being much more rapid and effective than hand work, requiring several men with mauls.

Where there are many obstructions in the ground, or where the strata are very hard or for any other reason the driving is difficult; where the piles are very long, or where the earth pressure seems to be very great, or it is necessary to provide a high degree of water tightness, or where the piles are to be pulled and redriven many times, it is generally advantageous to use interlocking steel piles. These may be of any of the standard makes on the market, which, however, are limited in number and can be had in only a few sizes, which, being required to meet all conditions, are necessarily designed to endure the heaviest driving and are therefore generally extravagantly heavy and expensive. Most of them are provided with a very substantial interlock that insures the engagement of successive units unless subjected to very severe treatment, but does not insure water tightness. The joints, however, are likely soon to become filled with silt or sand so that the flow of water through them is likely to diminish rapidly. Most of the rolled sections of steel sheet



PRINCIPAL TYPES OF STEEL SHEET PILES
The units made with channel bars are seldom or never used for sewer trenches.

piles weigh from 20 to 40 or 50 pounds per linear foot, are heavy to handle and require special equipment for their installation. They can be set by a locomotive crane, traveling derrick, stationary derricks or small gantries, the latter sometimes being designed to span the sewer trench and provide for driving or pulling piles on both sides simultaneously.

Sheet piles fabricated from single pieces of sheet steel cold-bent to a channel-shape cross-section with double flanges are free from many of the objections to rolled pile sections, and possess many advantages that the latter do not, particularly the remarkable flexibility enabling them to be selected to closely fit varying conditions on account of the fact that all of the dimensions and their weight and strength can be varied at will without involving delay or extra expense in their fabrication so that a light pile of great strength can easily be secured for hard driving and a still lighter pile, weighing as little as 3 pounds per square foot, can be provided for easy driving.

The piles may thus be selected to conform to each particular job and may be so light and cheap that it is economy to leave them permanently in the ground after serving their original purpose, or strong enough to be pulled and redriven again and again a great number of times. The interlock is easy and perfect and the reduced weight, very seldom being more than 10 or 12 pounds per square foot for the heaviest unit, effects a great economy in transportation and handling besides the original saving in purchase.

Another great advantage possessed by these piles is the special method of installation with removable driving bars that enables them to be driven without injury through very hard ground or ground containing logs, boulders and other obstructions. This method may be applied without additional cost to piles intended for ordinary driving. If unexpected conditions require the piles to be longer than have been provided, the lighter weights can be advantageously spliced in the field at small expense.

130-Pound Rails for Pennsylvania Railroad

In 1875 the Pennsylvania Railroad laid 60-pound rails, substituting 70-pound for these in 1884, adopting a 75-pound rail in 1886, and 85-pound in 1887. Rails weighing one hundred pounds to the yard were first laid by this railroad in 1892. Figures compiled in November of this year show that on October 1 that railroad had replaced 44 per cent of the main line trackage in the New York, Philadelphia, Baltimore, Maryland and middle divisions and at the Philadelphia terminal with 125-pound and 130-pound rails; the total mileage so replaced being 705, of which 46.9 miles is in the Philadelphia terminal, and 166 miles in the New York division.

The constantly increasing weights of locomotives and cars and the strain of constantly increasing traffic decided the company to adopt these heavier rails, the company's experts after six years of experimenting with and studying these rails having concluded that their use would insure a greater degree of safety and longer life for the rails.

Municipal Electric Light, Heat and Power Plant for Newark

The voters of Newark, N. J., recently authorized the officials to construct a municipal gas and electric light, heat and power plant and Director Raymond of the Department of Streets and Public Improvements is taking steps to carry out these instructions. Among other moves he has asked F. W. Ballard of Cleveland, Ohio, to visit Newark for consultation and for explaining before the Federation of Improvement Associations what he has done in Cleveland. (Mr. Ballard, as commissioner and chief engineer of the Division of Light and Heat of Cleveland, was chiefly responsible for the success of the municipal lighting plant of that city.) The Chamber of Commerce of Newark announces its intention of instituting legal proceedings to prevent the construction of a municipal plant, it having been informed that the project would cost several million dollars and that the city's financial condition would not permit the raising of the necessary amount.

Salaries of Philadelphia Employees

The Bureau of Municipal Research and other civic organizations of Philadelphia are urging the city authorities to increase the pay of its employees, both in justice to them and in order to secure and retain a desirably high grade of services. While the cost of living has increased more than 100 per cent since 1914, the general level of city pay has increased about 43 per cent. "If the city government were to pay its employees according to standards that obtained in 13 other large cities in the United States in 1914 and 1915, it would have to raise the general level of city pay at least 55 per cent," while local private establishments in 1915 were paying at least 18 per cent more than the city.

The Bureau of Municipal Research has published a table comparing the average annual compensation of employees in the city service with those occupying similar positions in private service in that city. These include electrical, mechanical and structural engineers, blacksmiths, chauffeurs, nurses, office boys, etc. In every case the city pay is less than private pay by from 7 to 98 per cent. The city pays a senior electrical engineer $2,300 as compared to $3,600 for similar services in private employ. Survey engineers receive $4,500 as compared to $6,240, assistant structural engineers are paid $2,556 by the city and $3,033 by private employers, laborers receive $1,118 and $1,258 in the two services, respectively. "This condition of underpayment . . . is unfair to the employees of the city and it is ruinous to the efficiency of the service. . . . The Bureau of Surveys is unable with its depleted corps of technical men to keep abreast with its important current work."

Recent Legal Decisions

PUBLIC SERVICE COMMISSIONS' POWER OVER WATER SERVICE AND RATES

In actions to recover payments claimed under contracts to supply water for hydrants to two boroughs, the New Jersey Supreme Court holds, Hackensack Water Co. v. Tenafly and Ridgefield, 111 Atl. 261, that under the State Public Utilities Act the terms of the contract between the water company and others, including municipalities, are determined by the public utility commission. It has power to prescribe the character of the service to be furnished, as well as to prescribe the rates to be paid. It is open to municipalities and to individuals to accept or reject the service at these rates. If they accept, as the municipalities did in this case, they accept the terms as prescribed by the commission, which necessarily means the character of the service as well as the rates of payment. Where suit is brought for the contract price, the only question open is whether the utility has furnished the service prescribed. It is not open for a court or jury to find that other facilities than those prescribed by the commission would be adequate, or that the facilities furnished, if in compliance with the order, are inadequate. In order to preserve uniformity and avoid the discrimination forbidden by the act it is essential that the commission control this question of service and rates. This is the effect of the decision in the United States Supreme Court dealing with interstate commerce cases. Until the commission has determined what facilities are adequate, no action can be brought or defense made where there is a controversy on the point. In the present case the commission has determined what facilities are adequate and what the price shall be; the only question left open is whether these particular facilities as prescribed by the commission's order have been actually furnished. So far as the defendant's defense did not question the rate or aver that the facilities prescribed by the order of the commission were not adequate, but merely stood on the commission's order and denied that the plaintiff had performed, they were held sufficient.

CONTRACTOR'S PAVING GUARANTY CONSTRUED

In a suit on tax bills issued by a city for sidewalks, the defendants contended that the guaranty contained in the paving contract that the work should be constructed with such materials and in such manner that it would endure without any repairs for seven years after completion and acceptance, bound the contractor to so construct the pavement that it would not need repairs for seven years in any event, and that if, in order to do so, it was necessary to use for flushing a compound containing a larger percentage of cement than that which was used, the contractor was bound to use such a compound. The Missouri Supreme Court holds, Schropp v. Zeilda Forsee Inv. Co., 224 S. W. 424, that this guaranty does not go to that extent. It merely operates to bind the contractor to make such repairs as may become necessary within the time fixed in the contract. The fact that repairs may be needed within less time than seven years during which the guaranty runs imposes an obligation on the contractor to make the repairs without charge, but does not vitiate the tax bills which have been issued for the work already done.

FRANCHISE EXCEEDING AUTHORIZED PERIOD VOID IN TOTO

The Kentucky Court of Appeals holds, Hamilton v. Bastin Bros., 224 S. W. 430, that the provision of the Constitution of Kentucky that no municipality shall grant any franchise or privilege for a term exceeding 20 years is mandatory and cannot be evaded or disregarded in any material particular. A franchise to construct and operate an electric lighting system, granted by a city to purchasers from and after the passage of an ordinance of September 23, 1916, continuously until July 1, 1917, and for the additional term of 20 years thereafter, is held violative of the Constitution, in its inclusion of the period of 9 months and 7 days up to July 1, 1917, though such excess time over 20 years was merely given the purchasers of the franchise for construction, and not for operation, of the plant. The purchasers had the right to abandon the franchise at any time, and were not obliged to operate their plant throughout the period limited by the franchise.

CONSTRUCTION OF ROADS BY SPECIFIED ROUTES

The West Virginia Court of Appeals holds, Haws v. County Court of Wayne County, 104 S. E. 119, that voters, in the issuance of bonds for the purpose of raising funds for the construction or improvement of public roads, may place upon the expenditure of such funds any limitations or restrictions not forbidden by the fundamental law, and the authorities charged with the expenditure of such funds will be enjoined from diverting the same to any other purpose than that to which they are directed to be applied by the terms of the grant. This applies to the construction of a road by an unnecessarily devious route, different from a practicable route specified in the grant.

JUDICIAL DEFINITIONS OF "GRADING" STREETS

To grade a street or highway, strictly speaking, is to establish a level by mathematical points and lines, and then to bring the surface of the street or highway to that level, by the elevation or depression of the natural surface to the line as fixed. Gas & Electric Securities Co. v. Manhattan, etc., Corp., 266 Fed. 625. In Sedgley Avenue, 217 Pa. 313, it is said that "as a matter of fact the grading of a street is its physical opening." Then, the court adds, when the city is in funds, the physical grading is done, and sewers and water pipes and gas pipes are laid as part of the work.

NEWS OF THE SOCIETIES

Dec. 27-Jan. 1 AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Smithsonian Institute, Washington, D. C. Chicago, Ill.

Dec. 28-31 AMERICAN ECONOMIC ASSOCIATION. Yale Station, New Haven, Conn. Atlantic City, N. J.

Jan. 19 — INTERNATIONAL CUT STONE CONTRACTORS' AND QUARRYMEN'S ASSOCIATION, Inc. Annual meeting. Congress Hotel, Chicago, Ill.

Jan. 19 — AMERICAN SOCIETY CIVIL ENGINEERS. New York City.

Jan. 25-27, 1921—THE AMERICAN WOOD PRESERVERS ASSOCIATION. Place of meeting to be announced later.

Jan. 25, 26, 27—ASSOCIATED GENERAL CONTRACTORS. Annual meeting, New Orleans. Secretary's Office, Washington, D. C.

Feb. 1-2—NEW YORK STATE ASSOCIATION OF BUILDERS. Convention. Rochester, N. Y.

Feb. 1, 2, 3, 1921—ONTARIO PROFESSIONAL MEETING in conjunction with the annual meeting of the Engineering Institute of Canada. Toronto.

Feb. 7—AMERICAN ROAD BUILDERS' ASSOCIATION. Annual convention. Coliseum, Chicago. E. L. Powers, 11 Waverly Place, New York City.

May 17-19—NATIONAL FIREMEN'S ASSOCIATION. Twenty-third annual convention. Fort Wayne, Ind.

June 7-9—NATIONAL FIRE PROTECTION ASSOCIATION. Annual meeting. San Francisco, Cal.

June—CONFERENCE OF MAYORS AND OTHER CITY OFFICIALS, State of N. Y. 12th Annual Conference. Elmira, N. Y.

June 6-10, 1921—AMERICAN WATER WORKS ASSOCIATION. Annual convention at Cleveland, Ohio. Secretary, J. M. Diven, 153 West 71st St., New York.

FEDERAL HIGHWAY COUNCIL

Why highways fail was taken up by engineers, highway officials and scientific men in leading universities at a meeting of the sub-grade committee of the Federal Highway Council, held at Wilmington, Del., November 22 and 23, under the chairmanship of General T. Coleman Du Pont of New York.

Among the scientific men attending were Professor Hector J. Hughes, dean Harvard Engineering School, Cambridge, Mass.; A. T. Goldbeck, testing engineer, Bureau of Public Roads, Washington, D. C.; Professor F. H. Eno, chair of engineering, Ohio State University; H. E. Hilts, of the Pennsylvania State Highway Department; H. G. Shirley, of the Federal Highway Council, and Ira B. Mullis, Bureau of Public Roads, Washington, D. C.

Reports were made by problem committees working under a main committee. During the discussion which followed, W. P. Blair, of Cleveland, Ohio, stated that twenty million people had been added to the population of the United States, practically without one inch being added to the transportation facilities of the country, and that on top of this increased population was an increased tonnage due to greater buying by the people equal to another twenty million, making a total of practically fifty million, in the face of inadequate transportation. The result of this increased tonnage, it was asserted, had been to break down roads through no fault of construction, but because traffic growth had not been taken into full account.

The development of railway engineering was used as an example to show why heavier type highways must be built, since the same law of tonnage growth applies to both the railway and the highway. In the case of the railway, Mr. Blair asserted, the laying of heavier rails, enlarging tunnels and reducing grades, has been going on constantly during the past thirty or forty years, and yet the highway, without a comparative development, had been called upon within the last ten years to sustain a traffic growth unequaled in any like period in the history of the country. The situation this created, it was pointed out, called for a determined effort to build better road foundation in order that breaks in the surface may be eliminated.

General Du Pont said that it was his belief that the foundation problem must be solved and solved speedily, otherwise the movement to round out a complete system of county, state and interstate highway transportation will be retarded to the great detriment to the American public.

C. M. Upham, state highway engineer of Delaware, explained how his department was making field tests to determine the bearing power of various kinds of soils and what methods to pursue in order to increase that sustaining power and thus prevent the breaking down of the road surface.

On the point of road failures, Mr. Shirley, former state highway engineer of Maryland, called attention to the fact that roads are sometimes charged with having failed, despite the fact that in actual service they may have saved their cost many times over before reaching the point where reconstruction becomes necessary.

S. M. Williams, chairman of the Federal Highway Council, addressed the committee briefly upon the importance of conducting the sub-grade research work as rapidly as possible in order that road building upon a greater scale than ever before may go forward without wasteful expenditure of funds.

Investigations in widely separated sections of the United States are to be conducted simultaneously and reports made at subsequent meetings of the sub-grade committee. The work is under the direction of the Federal Highway Council, which hopes, through the movement now undertaken, to save millions of dollars to the public in the future in the construction of roads that will not fail.

THE ENGINEERS' CLUB OF PHILADELPHIA

On December 21, at 8:15 p. m., this club will hold a meeting in its auditorium on the subject of "Road Construction for Heavy Truck Traffic." A number of prominent authorities, including state highway commissioners, will be present and papers will be read and a general discussion had on the subject in order to bring out information of practical value.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

The forty-first annual meeting of the American Society of Mechanical Engineers was held December 7-10 in the Engineering Societies Building, New York City. On Monday morning, December 6, were held the conference of local sections' delegates, and the meeting of the Committee on Power Test Code. On Tuesday afternoon, December 7, there were simultaneous sessions. of the fuel section, the forest products and the machine shop sections. On Tuesday evening were the report of tellers of election and the introduction of the president-elect, the presidential address, the conferring of six honorary memberships, and the presidential reception and dance.

The regular business meeting took place on Wednesday morning, at which time amendments were made to the constitution, and reports given by standing committees, and the committees on code of ethics, industrial relations, education, feedwater-heater standardization and the sub-committee on bearing metals.

On Wednesday afternoon were the meetings of the management and railroad sections, and on Wednesday evening the Brashear Memorial, at which an oration on the life and work of the late Dr. John A. Brashear, past-president of the A. S. M. E., was delivered by Dr. Henry S. Pritchett, president of the Carnegie Foundation for the Advancement of Teaching.

On Thursday afternoon, December 9, were the organization meeting of the ordinance section and the Ladies' Tea and Dance.

On Friday morning were held meetings of the textile and power sections. The subject of the power session was "Future Power Development," and papers were presented on the "Policy of Future Power Development," "The Effect of Load Factors on Cost," "The Effect of Size of Plant and Cost," and the "Financial and Legal Aspects of Future Power Development."

The keynote session on transportation was held on Thursday, December 9, when the subject was ably treated by well-known authorities in the field. The railroad situation was considered from two points of view, that of the railroads themselves, discussed by Daniel Willard, president of the Baltimore & Ohio Railroad, and that of the Development of Railroad Feeders, which was discussed by Charles A. Morse, chief engineer of the Chicago, Rock Island & Pacific Railroad. The Importance of Waterways in Transportation was taken up by Gen. Frank T. Hines, and that of Motor Truck Transportation by Francis W. Davis, engineer, Pierce-Arrow Motor Car Co. The question of Terminals in General was presented by Col. William Barclay Parsons, consulting engineer, New York City, and that of the New York Terminal Problem by Gustav Lindenthal, consulting engineer, New York City.

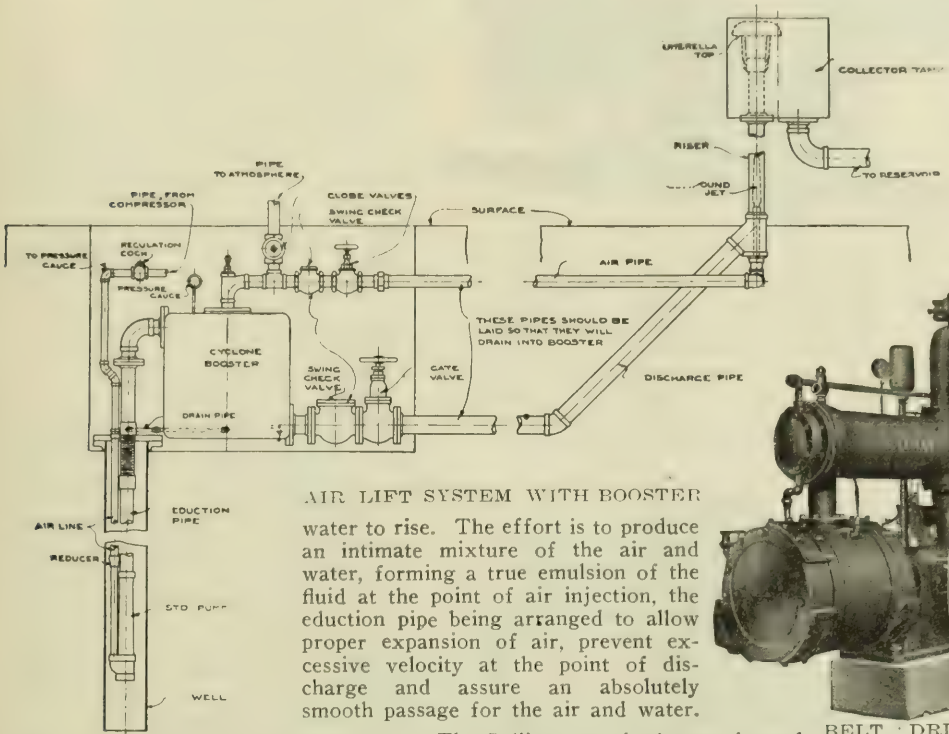
New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

SULLIVAN AIR LIFT PUMPING SYSTEM

The principles of elevating water and other liquids by the air lift method are discussed, and the apparatus for this purpose is illustrated and described in Bulletin 71-D issued by the Sullivan Machinery Company, which employs a separate corps of engineers devoted entirely to problems relating to pneumatic pumping, to which is applied a successful experience of more than 25 years of manufacture and installation.

The essential feature of air lift pumping is in the introduction of air, under pressure greater than the hydrostatic head, into the foot of the discharge pipe through which the water rises to the outlet or reservoir. The theory of operation is that the introduction of air into the water reduces the specific gravity of the mixture so that an unbalanced pressure is developed that causes the mixed air and water to rise. The effort is to produce an intimate mixture of the air and water, forming a true emulsion of the fluid at the point of air injection, the eduction pipe being arranged to allow proper expansion of air, prevent excessive velocity at the point of discharge and assure an absolutely smooth passage for the air and water.



AIR LIFT SYSTEM WITH BOOSTER

The process is especially adapted to deep well pumping and the principal advantages include the delivery of more water from the same wells than by any other system; improvement in the character of the water as to purity and solubility due to aeration; reduction in temperature due to absorption of heat in the water by the air; absence of moving parts in the well, and freedom from injury or obstruction by mud, silt, sand or long shut-downs; all of them operating to keep the apparatus always in order and to provide sustained efficiency.

The expansion of the air in the uptake pipe of the lift absorbs heat from the water and lowers its temperature, thus affording an important advantage, especially in water used for condensing purposes.

It is claimed that the air lift installation is more durable and requires less attention and repairs than any other method of pumping, no farther attention being necessary after the installation has been properly adjusted in the well.

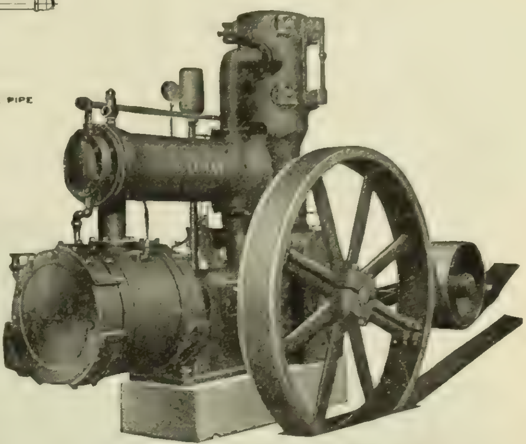
The Sullivan standard pump is made of bronze with an air passage leading from the outside, terminating in a perforated vertical tube below a Venturi or throat so that the air is broken up into small jets automatically providing a larger or smaller proportion of air according to the lift, without change in the pump opening, so that the mixing tube receives the sand and scale and prevents them from clogging the perforations. The remainder of the apparatus is made up of standard pipes and simple fittings and is operated with air provided by a suitable compressor selected from a number of sizes and types illustrated in the bulletin.

By the use of a "Cyclone" booster or separator system, in which the water from the well is discharged by the high velocity to the booster tank where it acquires a downward centrifugal action that completely separates it from the air and is subjected to the required pressure, it may be forced to the desired additional height.

The bulletin gives a number of valuable tables of the dimensions and capacities of pumps, pipe sizes, thicknesses, weights and fittings, capacities of cylinders, loss or head of water in pipe due to friction, h. p. required for air compression, flow of air through orifices and cylinder piston displacements.

FLEXATILE EQUIPMENT PAINT

The Hepps roofing division of the Richardson Company has issued a circular making a special offer to contractors to furnish in metal barrels, half barrels and cans, especially prepared asphalt paint to preserve contractors' equipment. This paint is intended to be used on plant laid up for the winter, and is offered at a reduced rate.



BELT DRIVEN COMPRESSOR TO OPERATE AIR LIFT

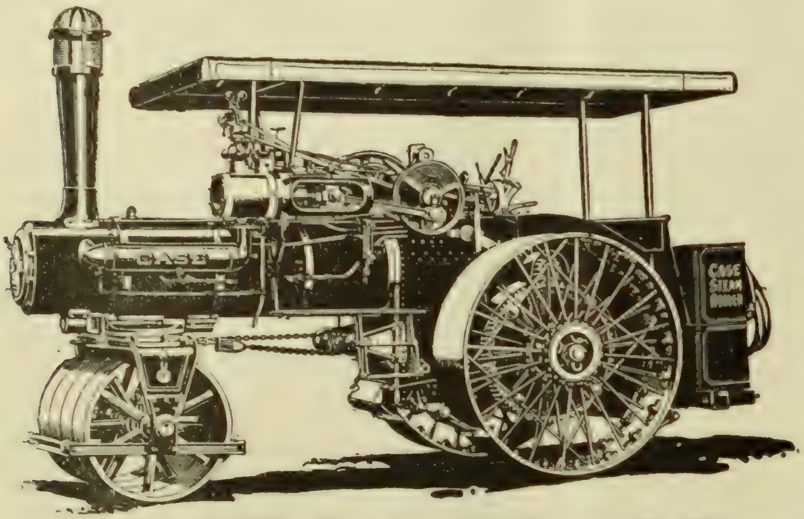
BENJAMIN-STARRETT STANDARDIZED PANEL BOARDS

The sectional unit panel board made by the Benjamin Electric Manufacturing Company and described in catalog F-3 is designed for all standard arrangements of bus bars and main connections, and is adaptable for increased mains, sub-feeds, and through feeds, with regular listings of four to thirty circuits. The boards have a moulded composition base electrically and mechanically superior to slate and weighing one-half as much, behind which the bus bars are concealed, leaving the front of the board of a reduced size, clear for a better spaced assembly of fusing and switching arrangements.

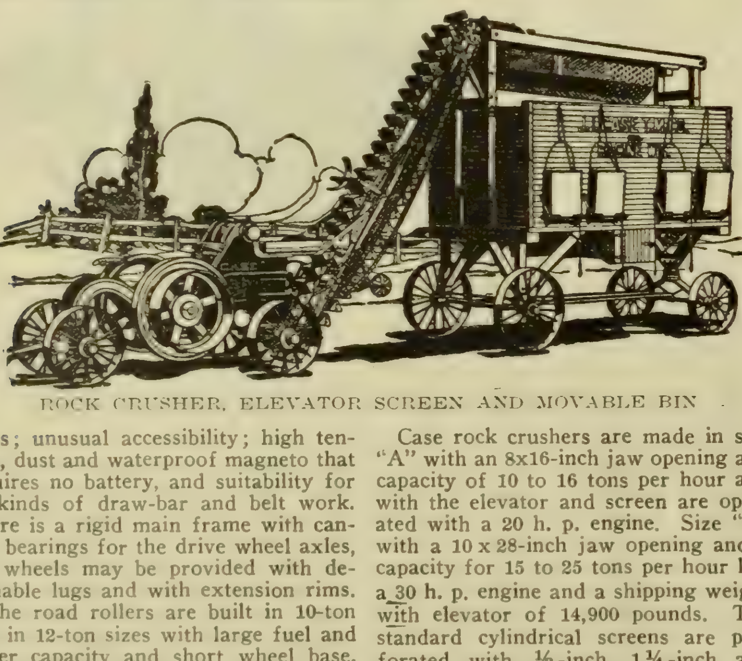
The panel bar is made up of interchangeable unit panel sections that are carried in stock and can be ordered by catalog numbers to great advantage, eliminating delay and unavoidable expense due to detail specifications and special construction.

CASE ROAD BUILDING MACHINERY

Tractors manufactured by the J. I. Case Threshing Machine Company, Incorporated, are offered by them for general service in road building operation. The steam tractors are made in eight sizes of 30, 40, 50, 60, 65, 75, 80 and 110 h. p., while the kerosene tractors are made in four sizes of 10-18, 15-27, 20-40 and 22-40 h. p. The features for which special merit is claimed include the four-cylinder valve-in-head motor that burns kerosene economically and will stand severe service, liberal reserve in excess of rated h. p.; simple and durable type of transmission with all cut-steel spur gears; dustproof and oiltight housings for all vital working parts; unusual accessibility; high tension, dust and waterproof magneto that requires no battery, and suitability for all kinds of draw-bar and belt work. There is a rigid main frame with cannon bearings for the drive wheel axles, the wheels may be provided with detachable lugs and with extension rims.



KEROSENE BURNING STEAM ROAD ROLLER AND TRACTOR



ROCK CRUSHER, ELEVATOR SCREEN AND MOVABLE BIN

The road rollers are built in 10-ton and in 12-ton sizes with large fuel and water capacity and short wheel base. Like the tractors, they are provided with driving pulley for belt operation of other machinery, such as a rock crusher, concrete mixer or large pump.

The roller makes an efficient tractor for slow, heavy work. It is provided with a friction clutch and differential gears, and has scrapers on both front and rear rollers. The rear axle has cannon bearings and the engine and boiler are provided with spring mounting. They have an especially simple and efficient valve gear and a power steering device that turns the front roller whether or not it is in motion.

Detachable taper spikes protruding 4½ inches are provided for the rear roller for use in loosening old roads and can be inserted or removed in twenty minutes. The front rolls are made in four sections 12½ inches wide and 41 inches in diameter, enabling the machine to turn around in a 24-foot circle.

Case rock crushers are made in size "A" with an 8x16-inch jaw opening and capacity of 10 to 16 tons per hour and with the elevator and screen are operated with a 20 h. p. engine. Size "B" with a 10 x 28-inch jaw opening and a capacity for 15 to 25 tons per hour has a 30 h. p. engine and a shipping weight with elevator of 14,900 pounds. The standard cylindrical screens are perforated with ½-inch, 1¼-inch and 2½-inch diameter holes and are served by bucket elevators. The standard size bin has a capacity of 15 tons, and is divided into four compartments, each of which has two loading spouts, one on each side.

PERSONALS

Hepburn, Donald M., at one time chief of the Bureau of Street Cleaning, and later chief of construction of the Pennsylvania State Highway Department, has resigned the latter position to take one in New York state.

Voyles, Fred, has been appointed county highway commissioner of York county, Neb., to succeed his brother, Glenn I. Voyles, who resigned to accept a position with the Western Bridge Co., of Omaha, Neb.

Mitchell, McClain, superintendent of public improvements of Paducah, Ky., has been appointed city engineer.

Arnold, Ralph R., county engineer of Contra Costa county, Cal., has been appointed highway engineer.

Watkins, Vaughn, of Jackson, Miss., has been appointed state highway commissioner of Mississippi.

Moisseiff, Leon S., designing engineer for the New York Department of Bridges during the construction of the Williamsburg, Manhattan and Queensborough bridges, has been appointed consulting designing engineer on the technical staff for the engineering investigation of the proposed bridge over the Delaware river, between Philadelphia and Camden.

Wilson, H. Lee, assistant city engineer of Johnstown, Pa., has been appointed city engineer to succeed Jackson R. Crissey, who has resigned.

Meloy, Bruch L., formerly field engineer of Johnstown, Pa., has been appointed assistant city engineer.

Biggs, Dr. Hermann M., health commissioned of New York state, has temporarily assumed the duties of general medical director of the League of Red Cross Societies, Geneva, Switzerland.

West, W. C., formerly resident engineer on work on the Dixie Highway north of Toledo, Ohio, is now assistant district engineer at Saginaw, Mich.

Dawson, J. B., formerly division engineer of District 9, Kentucky State Highway Department, has been appointed maintenance engineer.

Foster, C. F., assistant district engineer of bridges, central and southwestern districts, Michigan State Highway Department, has been appointed district engineer for the west central portion of the state with headquarters in Grand Rapids.

Bailey, S. M., formerly resident engineer for the Department of Public Works, Kentucky, has been appointed to a similar position with the North Carolina Highway Commission.

Symons, Col. Thomas W., Corps of Engineers, U. S. A., for thirty years in service with the government, died on November 23 at Washington.

Leidl, Edward F., chief engineer of sewers, Milwaukee, Wis., since 1914, died on November 21.

Goodbody, Richard H., formerly superintendent of streets, San Diego, Cal., died in that city on November 20.

Cassidy, Roger, has resigned as road engineer of Fleming county, Kentucky.

Henderson, R. H., now mayor of San Angelo, Tex., has been appointed city manager.

PUBLIC WORKS.

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Entered as Second Class matter at the Post Office at Floral Park, N. Y., August 27, 1920, under the Act of March 3, 1879

Vol. 49 FLORAL PARK, DECEMBER 25, 1920 No. 26

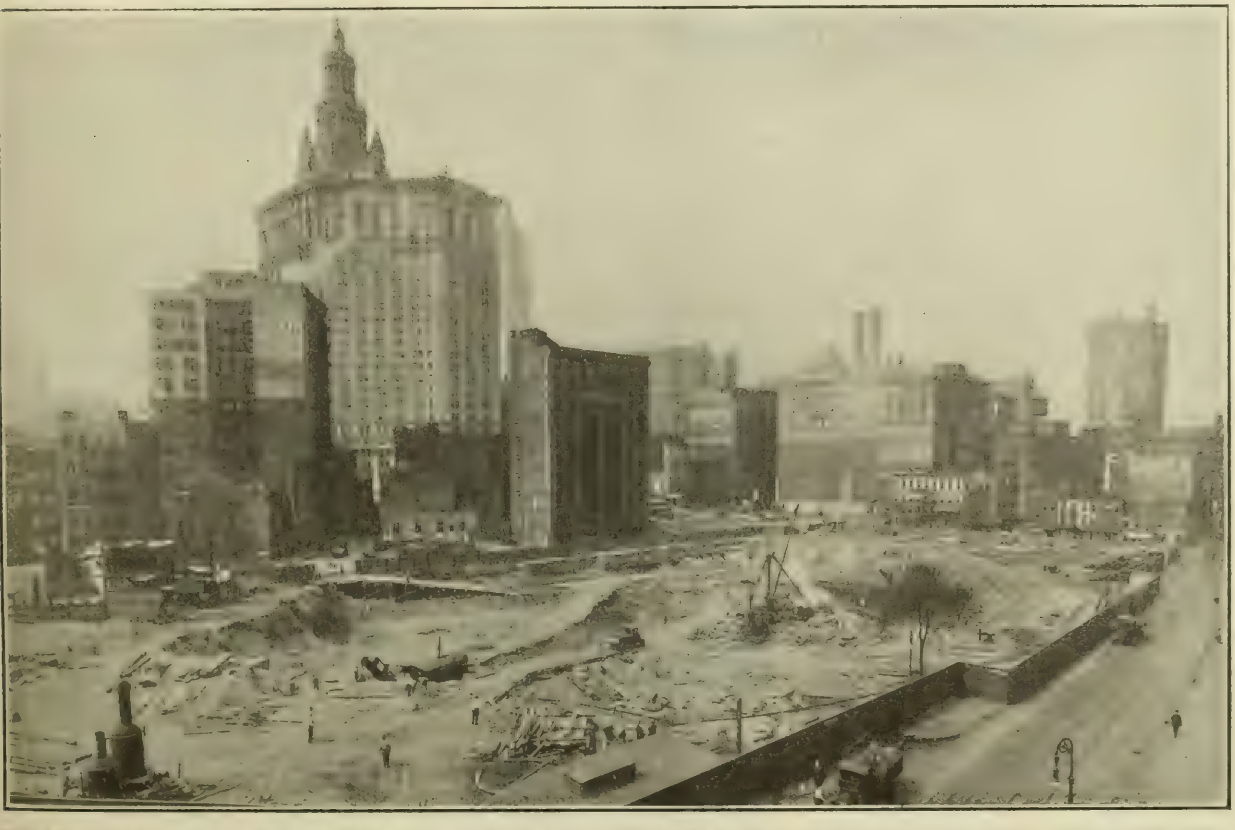
A Concrete Job Mechanical

Building the 320-foot diameter hexagonal sub-structure, 30 feet deep, for the New York County Court House. Methods and plant for excavation and removal of 94,000 yards of material and for mixing and placing 19,000 yards of concrete entirely with power plant.

The new $20,000,000 Court House for the County of New York is located on Center street, a few hundred feet from the great Municipal Building. The buildings formerly occupying this site were taken down several years ago. During the intervening period between that time and the present a quantity of ashes were dumped into the open cellars resulting from the razing of the old buildings. During the war the United States government used this area as a naval encampment.

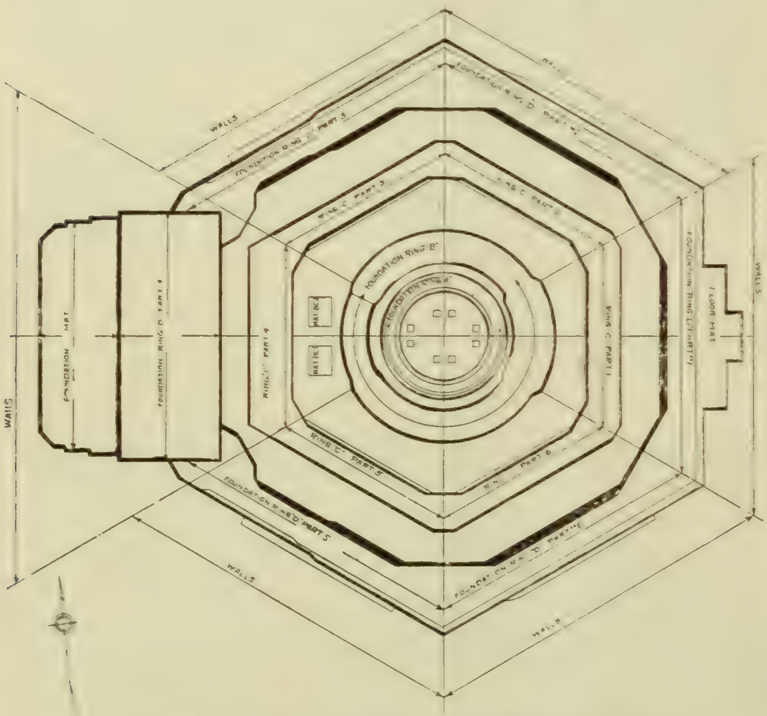
The excavation under this contract therefore consisted of several classes: Miscellaneous for a depth of about 10 feet; masonry foundations amounting to several thousand cubic yards; and an underlying stratum of well-graded sand below the old cellar levels.

Due to water being reached at elevation + 2.0, a great deal of pumping has been required to successfully carry the excavation down to elevation — 11.75, the sub-grade of the foundation rings



STEAM SHOVEL MAKING FIRST CUT IN CENTER AT SECOND LIFT OF EXCAVATION. EMPTY TRUCK DESCENDING SOLID EARTH RAMP FROM STREET LEVEL

EXCAVATING LAST CUTS, ABOUT 30 FEET BELOW STREET LEVEL



GENERAL PLAN OF CONCRETE FOUNDATION WALLS

of the new court house. The quantity pumped has averaged about three and a half million gallons per twenty-four hours. The entire excavation is approximately about 500 feet long, 320 feet wide and about 30 feet deep.

TYPE OF SUB-STRUCTURE

The masonry included in this contract consists of foundation rings, the sub-basement floor and the exterior walls extending up to street grade.

The foundation ring system consists of four concentric, reinforced concrete rings, the outer two being hexagonal in plan and the inner two being circular. The extreme outside ring supports the exterior walls, these walls in turn forming the areaways of the completed building. It is proposed to make the floor a reinforced concrete slab about 2 feet thick, the top of this slab system being at the same elevation as the tops of the concentric footings and supported on haunch walls, which are a part of the rings. As the floor will be subjected to hydrostatic pressure from below, the slab will be anchored down to the footings by a system of steel bar reinforcing.

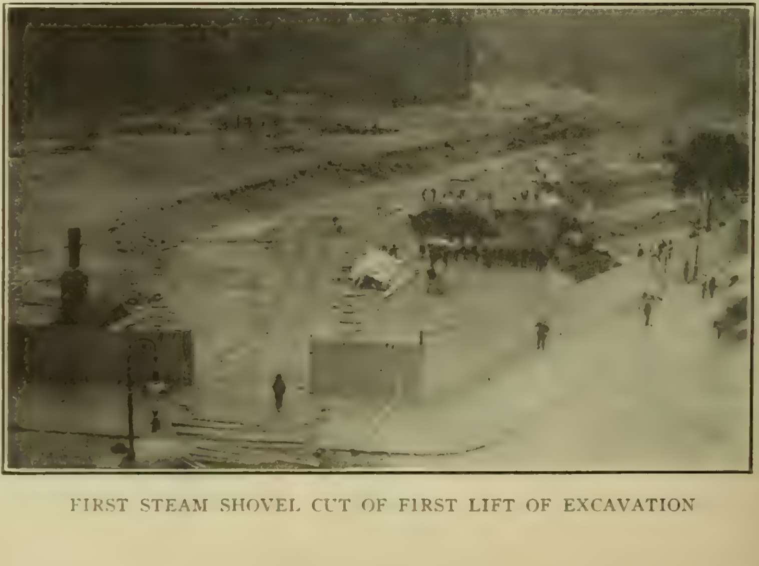
A very large amount of steel reinforcement is embedded in horizontal planes near the tops and bottoms of the rings, besides vertical reinforcement bars. Inside the center ring there are eight small independent rectangular column piers. The concrete in the sub-structure has a total volume of about 19,000 cubic yards of 1:2:4 mixture made with 1-inch broken stone and reinforced with about 1,250 tons of Havemeyer deformed bars, most of them in mill lengths of 38 feet, bent parallel to the curves of the rings.

The contract for the sub-structure was awarded August 15, 1920, to Rodgers & Hagerty, Incorporated, for about $2,000,000.

EXCAVATION

Excavation was done entirely by steam shovels, two of which were immediately installed, and the others following as soon as was practicable. Three of them were of the revolving type with 1-yard buckets. They were manufactured by the Bucyrus, Marion, Osgood and Thew companies.

The first shovel made a full-length cut across the width of the lot, traveling west on the east and west center line. The cut was about 30 feet wide and 10 feet deep, and at the farther end the shovel turned and came back to the starting point, widening the cut as it advanced. As soon as possible the other steam shovels were installed in the cut at the same level, working out from the center to the edges of the excavation, which, in general, were allowed to take a



FIRST STEAM SHOVEL CUT OF FIRST LIFT OF EXCAVATION natural slope within the limits of the excavation.

While three shovels were thus employed in completing the first lift, the other shovel made a full-length through cut on the second lift, where it was followed by the other shovels, which excavated in the same manner as for the first lift, and all proceeded to the third lift, completing the main excavation down to elevation -8.0, about 26 feet below the surface of the street and 10 feet below ground-water level.

The shovels delivered directly into a fleet of forty-five 5-yard elevating automobile dump trucks that followed each other closely, forming a continuous line passing the shovel, receiving the load and giving way to the next truck, so as to keep the shovels busy with very little loss of time.

When operations were commenced a ramp of solid earth was left at the east end of the pit for the entrance and exit of the trucks, and a hoisting engine was installed at the top of the ramp to haul out the loaded trucks. When the second lift of the excavation was commenced, there was constructed on the south side of the pit another ramp with wooden flooring and falsework trestle bents, which was maintained for trucking spoil from the second and third lifts of the excavation and from subsequent pits, and permitted the removal of the earth in the first ramp. Although the sand from the upper part of the excavation was coarse and sharp and well-suited for concrete, it was not accepted for this purpose and was all hauled about 1½ miles and dumped into scows at piers on both East and Hudson rivers.

AIR HAMMER IN TRAVELING TOWER DRIVING WOODEN SHEET PILES

SHEET PILING

Although there was considerable clearance between the bottom of the excavation and the margin of the street, enough generally to provide a one on one-half slope of material as it was left by the steam shovel, it was thought best to run no risk of caving in of the bank or undermining or settlements in the streets, and the sides of the pit were protected by a sheeting of Lackawanna steel sheet piles, 20 to 22 feet long, driven midway of the slope at about the bottom of the first life, to a penetration of 2 or 3 feet below sub-grade. These formed in all a total of about 900 linear feet of retaining wall and were driven at the rate of about 20 sheet piles per day by a McKiernan-Terry steam hammer. The piles were driven before the final lift was excavated.

STEAM SHOVEL BACK FILLING AROUND CONCRETE FOUNDATIONS

PUMPING

The large amount of ground water encountered necessitated vigorous pumping after commencement of excavation in the second lift. Accordingly an 18 x 18-foot sump lined with wooden sheet piles, and excavated by a 1-yard clam-shell bucket operated by a derrick boom, was driven down to about 3 feet below sub-grade and over it there was built a shelter in which were installed two Kingsford centrifugal pumps, 10-inch suction, one Kingsford centrifugal 8-inch suction, one Lawrence centrifugal 6-inch suction, one Lawrence centrifugal 4-inch suction, and two 10-inch Cameron steam pumps, all centrifugal pumps being electrically driven.

From the sump six shallow radial trenches 50 to 150 feet long were dug and in them were installed sections of spiral riveted 18-inch pipe which received the drainage from the lateral ditches reaching to all parts of the excavation and closely following the steam shovels, in which were laid ordinary tile drains. This system was easily shifted as the work advanced and kept the ground dry enough to support the steam shovels without difficulty. When the excavation had been completed to sub-grade a similar system of drains was permanently installed below the level of the footings and the ends of the drains were closed and covered by stone and gravel which freely admitted the water and prevented the accumulation of earth and sand that might stop them up. The drains were thus kept open so that the water was continually taken care of by the regular pumping that at the present time averages about 3,000,000 gallons in 24 hours and has been in the earlier part of the work over 4,000,000 gallons in 24 hours. Such water is usually handled by the centrifugal pumps alone, keeping the two steam pumps in reserve in case of emergency.

General excavation was carried down to grade elevation — 8.0, about 26 feet below the surface of the street and about 3½ feet above the bottom of the foundation footings.

This left about 3,000 yards of excavation still to be made for the footings, providing a quantity of fine sand about sufficient to backfill between the upper part of the footings up to the level of the bottom of the sub-basement floor. Consequently after the completion of the general excavation, two of the steam shovels, a Thew and an Osgood shovel, were left in the pit to handle the footing excavation, which was made simultaneously with the placing of the concrete below the sub-basement floor and was arranged as much as possible so that the shovels could in some instances excavate the footing trenches and pass the material back for backfill at the same motion of the dipper, thus eliminating rehandling of materials. In other cases the spoil from the footing excavation was piled in ridges or windrows parallel to the footing trenches, and afterwards backfilled by the steam shovel after the completion of the concrete footing, thus in both cases eliminating the necessity of hauling the material or rehandling it with derricks and buckets.

(To Be Continued)

ELECTRIC PUMPS DISCHARGING 3,000,000 TO 4,000,000 GALLONS DAILY. STEAM PUMPS IN RESERVE

DRIVING STEEL SHEET PILES WITH AIR HAMMER

Nelson P. Lewis Retires

Thirty-six years is an unusually long time for a municipal engineer to serve a single city, but this is the record of Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment of New York City, who thirty-six years ago entered the Department of Public Works of the City of Brooklyn (now Brooklyn Borough of Greater New York) by civil service examination. He was the first president of the Municipal Engineers of the City of New York, and on December 18 that society gave a banquet as a testimonial to him, at which were present, in addition to more than 300 members, the president of the borough, F. H. La Guardia, ex-President G. McAneny and most of the members of past Boards of Estimate and Apportionment. Governor Smith and other officials wrote letters of regret and of appreciation of Mr. Lewis' services to the city, and speeches of similar appreciation were made by President La Guardia, Rev. J. F. Berg, George McAneny and Charles Whiting Baker.

Mr. Lewis retires from the city's service this month, his announcement of this having been made about a month ago.

Asphalt Production, Refining and Storing*

By Herbert Spencer

The saving in the use of storage tanks by contractors, and designs for both temporary and permanent storage plants, are discussed by the author.

STORAGE

One feature that is of the utmost importance to the refiner as affecting prompt shipments of asphalt is the necessity of adequate storage at the point of delivery. With the increase in paving work, both in the cities and in the outlying districts, tank-car shipments have been called for to a much greater extent than package shipments, due to the saving effected. On a basis of asphalt costing $33 per net ton delivered, and assuming a loss of 5 per cent on material left in package, the following approximates the saving of tank-car shipments over package shipments:

Extra cost of package	$ 8.00
5 per cent loss in asphalt	1.65
Difference in labor of handling	.75
	$10.40

This is offset to some extent by the interest and depreciation charges on storage installation, but aside from the direct saving, the following indirect features indicate the greater efficiency of an asphalt plant equipped with adequate storage:

1. No demurrage on tank cars.
2. Prompt return of tank cars to refinery, insuring continued shipments.
3. No shut-downs due to delayed shipment.
4. No overheated material or wasted heat.
5. No congestion on material tracks.
6. Hot asphalt continually available.
7. Can be made portable for use on different jobs.

A survey of the contractors' end of the asphalt industry shows a decided shortage of storage facilities for asphalt, and has developed the fact that customers are utilizing tank cars for storage purposes. While this may be economical for the contractor, it creates a situation decidedly serious for the trade in general, as tank cars are delayed in being returned to the refinery, with a consequent decrease in the number available for use. The following table for the two months (August and September, 1919) indicates the delays in releasing tank cars after receipt by the consignee. The figures are taken for shipments to contractors both with and without asphalt storage, and represent the number of cars held for different periods before release to the railroad. Shipments are from Bayonne, N. J., and Baltimore, Md., to points between Cleveland, Ohio and St. Louis. Mo.:

[illegible]	[illegible] within 48 hours	Between 48 hours and 5 days	Between [illegible] days	Between [illegible] days	[illegible]
August	[illegible]	16	1	4	[illegible]
September	[illegible]	15	16	[illegible]	[illegible]

The average running time in 1919 between Atlantic Coast refineries and the vicinity of Cleveland was 19 days and from Atlantic refineries to vicinity of Chicago was 15 days. Assuming an average running time of 17 days from refinery to destination and the same time for return, a delay of 5 days at contractor's plant beyond the free time allowed requires 41 days between time tank car is loaded and returned again for shipment. At the height of the paving season, and with transportation in the condition existing at present, it is obvious that the installation of adequate asphalt storage facilities will do much toward lessening the time taken in returning tank cars, aside from the saving to the contractor. As a rule, municipal asphalt plants are equipped with adequate storage, and no delay is experienced in returning empty tank cars. The same holds true for the larger contractors doing work in the cities. The greatest trouble is experienced from contractors having isolated jobs in the outlying districts and in smaller cities where the yardage is small, and the contractor feels that storage is not economical for him. The question is therefore raised as to what type of storage is most suitable for asphalt plants.

For the more permanent installations, tankage is either of steel or concrete. Steel tanks are either large vertical units, or a number of smaller units aggregating the total storage required.

In designing storage tanks for asphalt, the size of the work to be done is one factor to be considered. Other factors include the distance of plant from the refinery, the length of time shipments take to reach destination and the quantity of asphalt to be used per day. Sufficient asphalt should be kept on hand to last at least one week, and if possible, a reserve stock in barrels or drums. On account of the difficulty of securing sufficient capacity for a plant from one tank car, it seems necessary to provide storage which can be set up at each location and can be salvaged for the next job. Such a type of storage tank is shown in the illustration. This consists of a large circular storage tank in the middle of which is set a heating chamber equipped with steam heating coils. The shell of the heating chamber being bottomless; the asphalt in the outlet tank is free to enter the heating chamber. It does this when the tank is in actual service, new asphalt constantly flowing in from the outer tank to replace that used from the heating chamber. Only the quantity needed for immediate use is kept hot and the mass in storage remains comparatively cool. This has the advantages of (1) economy of steam, there being no lost heat. All heat supplied is used in heating asphalt in the inner chamber, some penetrating to the outside mass and liquefying it sufficiently to enable it to flow into the heating chamber. (2) The asphalt is used as fast as heated, there being no chance for the penetration to change on account of prolonged heating.

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*Continued from page 572.

The pit for the tank is first prepared, the grade being set to allow for the sloping bottom. A 1:2:4 mixture of concrete is then placed 3½ inches thick, or thinner if the foundation warrants it. The coils, heating chamber and outer ring are then set, the plates for the outer ring being assembled in advance. This outfit is made in sizes from about 13,000 gallons to 90,000 gallons, costing, with heating coils and pipe complete, also with asphalt pump and 25 h. p. boiler, from $1,100 to $3,000, exclusive of labor in setting up. This will run from 20 cents per gallon, for the smaller sizes, to 6 cents per gallon for the larger sizes. The tank is shipped knocked down in five sections and can be moved from one job to another by unbolting the shell sheets and packing together. The design is by Walter E. Mills of Chattanooga, Tenn., who furnished the descriptive matter for this design.

Other styles of tanks include the underground concrete tank, with floors 3 inches to 4 inches in thickness and walls about 5 inches in thickness. Great care must be exercised to have these tanks waterproof, as endless trouble will result if water is allowed to penetrate. This can generally be secured by the use of asphalt waterproofing paper, or by the use of some of the moistproof compounds mixed with the concrete. In many cases it has been found economical to place the heating chamber at one end of the tank, with openings in the bottom of the partition to allow the asphalt from the storage to flow into the heating chamber. In this way the difference in temperature is maintained. The storage tank is equipped with a limited number of heater pipes, estimated as one square foot of heating surface to every 100 gallons of material. The heating chamber should be provided with one square foot of heating surface to every 20 gallons of material.

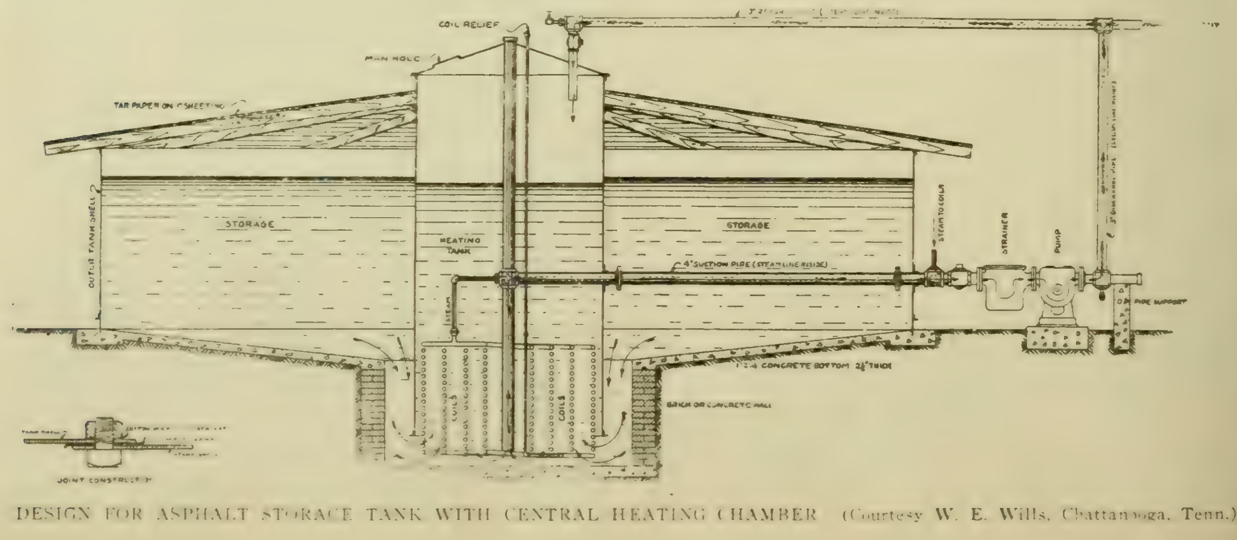
In some localities, and particularly where refineries are situated close to the larger cities, it is possible to deliver heated asphalt to contractors' plants or to municipal plants by means of bulk barge. Some producing companies operate barges equipped with steam coils and having capacities approximating 55,000 gallons. The asphalt is loaded into the barge directly from the stills or from storage tanks; it is then conveyed to the asphalt plant, the heat being maintained in the barge while the asphalt is being transported.

The city of New York takes a large part of the asphalt supply for its municipal plants in this way. Barges make deliveries from the refineries located on the Jersey shore to plants both in Brooklyn and New York City. This, of course, is only feasible where plants have considerable storage and there are facilities for loading and unloading barges and depth of water sufficient to take a lighter and tug. The asphalt, after delivery to the asphalt plant, is pumped to storage tanks and from there is loaded to heating kettles and then to the mixing boxes; compressed air being generally used to transfer the asphalt from one point to another.

Proposed Qualifications and Duties of County Surveyors in Montana

The Montana Assembly of the American Association of Engineers has printed a bill defining the duties and qualifications of county surveyors. It prescribes that the county surveyor shall be a professional engineer, not less than twenty-four years of age, who shall either be a graduate of a recognized college with at least two years' practical engineering experience or an engineer with seven years' experience, of which three shall have been in responsible charge of work. The chief deputy, authorized for counties of the first and second class, must have the same qualifications as the county surveyor. All other deputies shall be graduates or else shall have had five years' experience.

In addition to keeping suitable plat books, original drawings, etc., etc., the duties of the county surveyor are defined as follows:



DESIGN FOR ASPHALT STORAGE TANK WITH CENTRAL HEATING CHAMBER (Courtesy W. E. Wills, Chattanooga, Tenn.)

"The county surveyor shall be ex officio highway engineer for the county in which he resides, and shall work under the direction of the board of county commissioners, and under their direction he shall have charge and supervision of all highway construction and maintenance in his county, make all surveys; establish all grades; prepare all plans, specifications and estimates; approve all claims against the county for road and bridge construction and maintenance before the same is passed on and allowed by the board of county commissioners; purchase, subject to the approval of the board of county commissioners, all necessary machinery and supplies for road and bridge construction and maintenance; keep accurate cost data; shall discharge any delinquent or inefficient road overseer or other person employed upon the roads or bridges within the county; from time to time make progress reports and estimates of all work and such other facts in relation thereto as may be required by the board of county commissioners."

Another bill on compensation allows a salary of $3,600 per annum for county surveyors of first and second class counties and $3,000 per annum for surveyors of other counties. Chief deputies will receive $3,000 per annum and all other deputies a minimum of $200 a month.

Annual Report of Bureau of Public Roads

In this, Thomas H. MacDonald discusses the unfavorable conditions of 1920, reviews the work done and gives the present state of the Federal-aid fund.

Thomas H. MacDonald, chief of the Bureau of Public Roads, has just made public his report for the year ending June 30, but which contains certain figures brought up to October 1. Reference is made first to the effect of railroad congestion, strikes and labor and material shortages in interfering with highway work last year—facts which have impressed themselves only too emphatically on the minds of all those concerned in highway construction. Continuing to the matter of definite cost figures, Mr. MacDonald says:

"Sand, gravel, stone and cement, materials commonly used in road work, increased in price between 1917 and 1920 by from 50 to 100 per cent. Naturally, these increases in the costs of the essentials of construction have been reflected in the prices paid to contractors for road work. A comparison of the costs of several of the common types of roadway in the fiscal years 1917 and 1920, shows an average increase in the cost of earth roads from $2,160 to $4,100 per mile; sand-clay roads which in 1917 cost $2,460 per mile on the average, this year have cost $4,685. Gravel roads have increased from $4,535 to $7,250 per mile; concrete from a cost of $21,165 to upwards of $40,000 per mile; and a brick road which now costs $55,000 per mile could have been built in 1917 for $33,000.

"In view of the fact that the funds available for road construction are largely limited by statute or by the returns from taxation, and on account of the high prices prevailing, a majority of the states this year have deliberately withheld work, the plans for which have been completed, until such time as they could obtain a greater return upon the expenditure.

"No small part of the reason for the high contract prices is attributable to the uncertainty of rail deliveries of material. Contractors who have been induced to enter the highway field in larger numbers than ever before, and who have invested large capital in plant and equipment designed to expedite construction, have lost heavily by reason of the failure of the railroads to make deliveries of material in accordance with anticipated schedules; and they have advanced their prices on subsequent contracts in the attempt to recoup their previous losses and to provide against similar contingencies in the future.

"Reports received from the district engineers of the bureau at the end of the fiscal year show that as against 141 Federal-aid projects which were regularly receiving shipments of sand ordered, there were 68 projects which were seriously handicapped by delay in the receipt of this material. As compared with 128 projects which were receiving orders of gravel regularly, there were 108 which were held up by failure to receive it according to schedule; and though 167 projects were getting prompt deliveries of cement, there were 172 which were delayed by the inability to get shipments of this important material on time.

"In the spring of 1919 many thousands of open-top cars stood idle. As the season advanced, however, and highway work got under way car shortages developed here and there almost continuously, and several times during the season this condition was general. Road work was very seriously hampered, and many projects which could easily have been completed had materials been available were carried over to the 1920 construction season solely because of the delays incident to inadequate rail transportation service. In our endeavor to secure the maximum service from the available equipment, and to continue as much construction work under way as possible, close contact has been maintained with the Public Service Division and Car Service Section of the United States Railroad Administration. Much has been accomplished through this co-operation.

"With a view to making use of the open-top cars which ordinarily stand idle during the early spring months, the state highway departments were advised to let construction contracts early, and contractors were urged to make early shipments, storing the materials for future use. This effort undoubtedly contributed to the fact that in the spring of 1920 there was little if any surplus of open-top car equipment, whereas in the spring of

1919 upwards of 250,000 open-top cars stood idle for a number of weeks.

"With the return of the railroads to private control co-operative relations were established with the Interstate Commerce Commission and the Car Service Division of the American Railroad Association, in order to continue the work which had been carried on with the Railroad Administration. Everything possible has been done to assist the state highway departments in meeting their rail transportation difficulties. It is apparent that for several years the transportation of road building materials is going to be the limiting factor in our highway improvement program. It is imperative that the maximum possible service be secured from the available equipment. To accomplish this result the co-operation of the shipper, the contractor, the state highway departments, the Interstate Commerce Commission, the railroads and this bureau is necessary. The bureau is shaping its organization so that it will be possible in the future to render greater service in this connection than it has been able to in the past."

In discussing federal aid, he states that at the end of the fiscal year there remained unallotted $59,911,826; but considerable of the $109,838,174 apportioned has not yet been paid out for actual construction. During the year the amount of federal aid allotted to work which had been completed during the year was $35,436,336. These figures do not represent actual vouchers paid, but are compiled from reports of the district engineers on completed work and represent the value of the finished work more accurately than would the sum of the vouchers paid. The total cost of the work completed during the year, including the amount paid by the states, was approximately $80,000,000. Mr. MacDonald expects that this sum will be greatly exceeded next year. He compares the highway construction with federal aid with the work of constructing the Panama Canal, showing that the average of expenditure on the canal was $37,000,000 a year, or considerably less than half of the actual expenditure on federal aid roads.

"In order to provide a more rational basis for co-ordinated work on the part of the states, the bureau, in conference with the advisory committee of state highway officials, has initiated plans for a nation-wide survey of the roads of the country, and a classification of all highways in respect to their importance and character of service. The survey when completed will doubtless furnish the necessary data for the establishment of a classified system of highways similar to the French system."

Figures which he presents show that the bulk of the money spent on federal aid roads is being expended for roads of what he terms the high and intermediate types, 60 per cent for the former and 9 per cent for the latter, only about one-quarter of the money allotted having gone for roads of the lower type. He classifies as high type road bituminous concrete, concrete, brick, and sheet asphalt; as intermediate he classifies water-bound macadam with or without surface treatment, bituminous macadam and rock asphalt; and under the low type he classifies earth, sand-clay, shell, and gravel with or without surface treatment. Although the greater part of the money is spent for the roads of the high type, in point of mileage the roads of the low type constitute 66 per cent, the intermediate 7 per cent and the high type 24 per cent.

A tabulation is given of the projects for which plans, specifications and estimates have been approved for federal aid up to date. These show that of the 5,457.4 miles of pavements of a class better than water-bound macadam, 1,406.7 are bituminous, 3,308.3 are concrete and 351.1 are brick. In total mileage, gravel leads with 5,583 miles, earth is second with 3,701 miles and concrete is third with 2,534 miles.

Mr. MacDonald states that up to October 1, 1920, the total value of road building equipment and supplies turned over to the state highway departments from the surplus war materials approximated $100,000,000; 24,669 motor vehicles have been allotted, of which 22,719 had been delivered by October 1 of this year. A number of unserviceable motor vehicles were accepted by certain states with the idea that their parts could be used in the reconstruction and maintenance of other motor vehicles received from the army and that they would not be counted in the total allotment to the state. It is expected that considerable additional material will be made available as soon as a final decision has been reached relative to the abandonment of some of the larger camps and cantonments by the army.

Reference is made to the tests of road materials, investigation of impact, drainage, etc., which are being made by the bureau and which have been described at greater or less length in PUBLIC WORKS during the past few months. Investigations are also being made of the process of refining crude petroleums, exposure tests of road oils and asphalts to study the effect of weather and atmospheric exposure, investigation of the effect of so-called white and black alkalis from New Mexico on asphaltic cements, investigation relative to the new penetration needle, and study of density and voids in bituminized aggregates.

Pennsylvania's Highway Work in 1920

The State Highway Department of Pennsylvania during the 1920 construction season built approximately 410 miles of concrete roadway 18 feet wide. This is believed by the department to be the world's record for one season's construction of this type of road. (Illinois apparently makes the closest approach to this record in its 1920 construction, having put down approximately 339 miles of concrete this season.) About 350 miles of concrete construction under contract will go over to next year and it is proposed to award contracts for an additional 350 miles of concrete roadway early in 1921.

The maintenance department has this season entirely resurfaced 377 miles of macadam highway and surface-treated 1,580 miles. In all, the maintenance forces of the department maintained 9,503 miles of roadway, of which 463 miles were in boroughs and state-aid roads.

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A Well Co-ordinated Construction Job

The work on the sub-structure of the New York County Court House, described in this issue, is interesting because of its magnitude, the installation of a large amount of high-class equipment, the use of power plant superseding a large proportion of hand work, and the co-ordination of methods, apparatus and schedule so as to conduct different classes of operation simultaneously in a restricted area with a high degree of efficiency and without confusion, delay or interference.

The excavation and removal of a large yardage of miscellaneous material was rapidly accomplished by a liberal steam shovel equipment served by a large fleet of automobile trucks that, on account of the well-planned arrangement of cuts and sequence of operations, were able to keep the shovels almost continuously at work without the delays and interference often encountered in an attempt to serve steam shovels by a succession of separate vehicles.

An extraordinarily large amount of ground water was controlled by an ample pumping plant and a progressive system of drainage that sufficed to keep the excavation dry and solidified the bottom of the pit to a satisfactory degree during the process of excavation, besides providing a system that sufficed for the continued drainage of the pit while the remainder of the sub-structure work was being executed.

Before the excavating plant was completely withdrawn from any portion of the pit, concreting was commenced and was soon extended to different parts of the area while a considerable amount of heavy shovel and trucking work was in progress and was successfully carried out without materially restricting either of the operations, each of which under ordinary circumstances might naturally occupy all of the space to the exclusion of the other.

A high degree of efficiency was attained in delivering, storing and handling aggregate and mixing and hoisting concrete to a point outside the excavation and then delivering it through an overhead system to a duplex revolving spouting apparatus at an elevation giving clearance below it for all excavating and other construction apparatus while it freely commanded all parts of the work.

In this way the different operations were continued, simultaneous and independent of each other, and were carried on with standard plant and equipment, selected, combined and installed so as to secure a high degree of speed, simplicity and economy of operation and have a high salvage value when the work has been completed.

Our Service to Engineers

The existence of PUBLIC WORKS is justified solely by the service that it renders to its readers. Its policy and purpose are to give to its subscribers all information regarding public work of which they may be in need and to do such work with ever-increasing efficiency.

In the special field covering the promotion, design, construction, maintenance and operation of engineering work for the public and by the public, PUBLIC WORKS is co-ordinated with the interests of the engineers who create and execute the design. To them it gives the most abundant measure of services in many directions, some of which we believe are unequaled by any other publication.

For the purpose of making this institution of more value to the readers of our periodical, they are invited to ask questions concerning work of all sorts that may be unfamiliar to them. The wide experience of the editors, their large acquaintance and cordial relations with experts and specialists in all kinds of construction, enable them to secure such information more easily and promptly than the distant correspondents could get it for themselves. The information is forwarded to them as quickly as it can be prepared and afterwards, if it is of sufficient general interest, it is published under the heading of "Construction Questions Answered." The value of this service is indicated by the appreciative letter printed in this issue.

Sewer Tunneling Information

A city engineer who plans to drive a sewer tunnel this winter, a class of work unfamiliar to him, recently inquired of PUBLIC WORKS concerning the methods, equipment and progress of such operations. The editor advised him promptly concerning the general facts, and after a conference with experts especially familiar with this class of work wrote him in greater detail concerning it.

Answering this inquiry was a part of the service that PUBLIC WORKS is privileged to give willingly and freely to all its friends. As there are many other engineers and contractors who may have similar work to do without previous experience, the complete correspondence with the city engineer was published in the "Construction Questions Answered" department of December 11, on page 558. That the information was welcome and helpful to the inquirer is evident from his appreciative letter herewith:

Editor PUBLIC WORKS.
Dear Sir:

I am in receipt of your valuable letter dated December 1 containing data which is of much value to me at the present time concerning the driving of a sewer tunnel and sinking of shafts in our city, which work will be done this winter. I read your letter with much interest and I wish to say that I did not expect such a lengthy letter, going into every phase and covering every detail of the work, which certainly required much time on your part; therefor I am indebted to you for some returns and will send a memorandum of the progress of the work and also the cost in detail, which will be of value to you.

I wish to thank you for the interest you have taken in this matter.

Yours respectfully,
CITY ENGINEER.

Highway Engineering Instruction in Philadelphia

The civil engineering department of the University of Pennsylvania has arranged for a brief course in highway engineering to be given from January 24 to February 11, 1921. The first two weeks of the course will be devoted to intensive instruction in highway engineering, a study of engineering materials, the design and construction of highway structures and the testing of materials used in road construction. The third week of the course will be devoted to a highway engineering conference, at which papers will be read by eminent specialists on all the phases of the design and construction of roads. The object of this course is to make it possible for more men to train themselves for highway engineering work. With nearly $1,000,000,000 now available for highway construction under the control of engineers, there will be a necessity for a very large number of men especially trained in highway engineering. At present there is a lack of engineers technically trained in highway work and there will be excellent opportunities in this branch for men who have had some practical experience in highway construction and who, in addition, have had training in the elements of road engineering and testing and inspecting of materials used in the construction of roads.

A conference will be held under the auspices of civil engineering department of this university, of which the professor in charge is Milo S. Ketchum, on February 14 to 19, 1921, at which officials of the highway departments of Pennsylvania, Delaware, New Jersey and Maryland and of the Bureau of Surveys will be present. Among the representatives of the Pennsylvania State Highway Department who will address the conference are George H. Biles, assistant state highway commissioner; W. R. Wolfinger, assistant construction engineer; A. H. Sauerbrun, construction superintendent; H. S. Mattimore, engineer of tests, and E. H. Hilts, principal assistant to the chief engineer.

There is an advisory committee, composed of Col. W. D. Uhler, chief engineer of the Pennsylvania State Highway Department; Charles M. Upham, of the Delaware Highway Department; John M. Mackall, Maryland State Roads Commission; T. J. Wasser, New Jersey Highway Commission, and George S. Webster, chief of the Bureau of Surveys of Philadelphia

Contractors Ask Reimbursement For Increased Freight

The Contractors' Association of New Jersey has asked the State Highway Commission to reimburse the contractors doing work for that commission for increased freight rates imposed upon them by the new tariff schedule. Attorney-General McCran has given his opinion that it is within the power of the commission to provide for such reimbursements, but the commission decided that the question was one which properly should be left to the legislature, and made no decision in the matter.

New Water Works For Bloomington

The City Council of Bloomington, Ind., has decided to construct a new water works system for that city, the estimated cost of which will be between $500,000 and $750,000. For several years there has been overhanging the city the serious danger of a water shortage. The plant has been increased in size at four different times, but the reservoirs from which the supply is drawn suffered serious leaks because of the geological formation.

It is proposed to abandon this system and build a dam and impounding reservoir across the valley of Griffy creek, three miles north of the city. This source had been discussed for a number of years and has been approved by a well-known engineering firm, but the city proposes to have it reported upon by another engineering expert before definitely deciding upon the final plans.

Point Pleasant Buys Water Work

The Public Utilities Commission of New Jersey has approved the sale of the Point Pleasant water works to Point Pleasant for $125,000, this price excepting book accounts and stock on hand.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

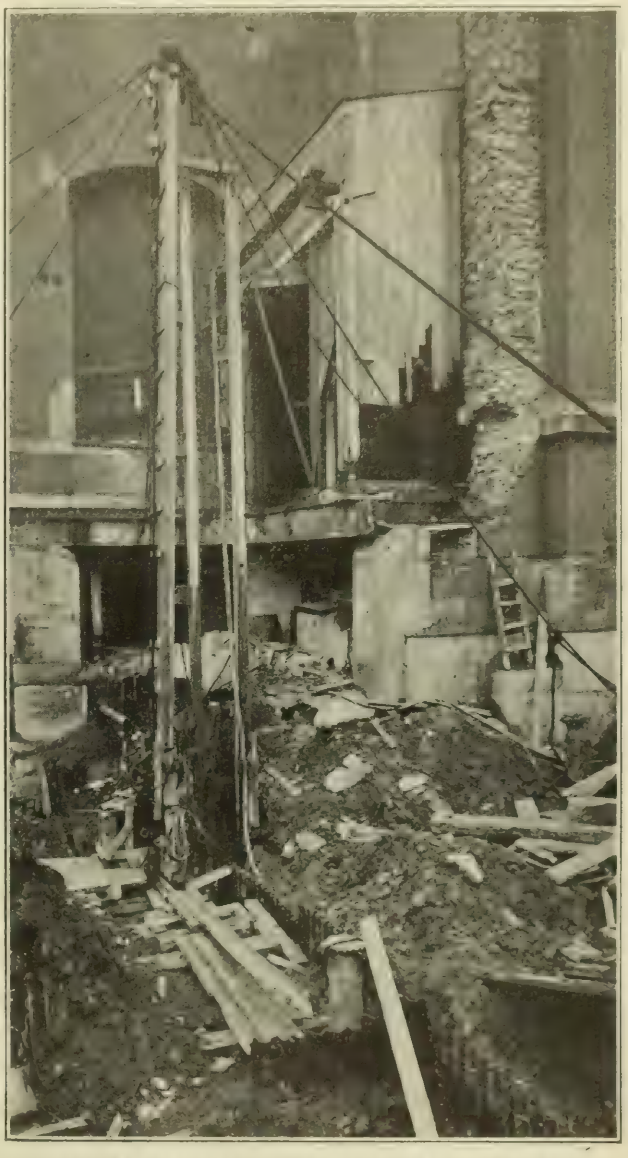
Sheeting Sewer Trenches*

Driving and pulling sheet piles. Use of air hammers, water jets, hand levers, gantries and derricks. Strengthening and splicing.

Ordinarily large jobs of sheet pile driving are done with small special air or steam hammers designed for the purpose, that are provided with jaws to engage the top of the pile and have a shelf or step at the lower end for the operator to stand on, adding his weight to the driving effect of the hammer. The hammer strikes light blows with great rapidity and drives the pile steadily without injuring it, while heavy blows might disturb the pile and still not cause satisfactory penetration. Where the regular sheet pile hammers are not available, rock drills can often be easily modified to serve the same purpose.

If the piles are very long or very thick and heavy, air or drop hammers are used in which the hammers are much heavier and require the use of a derrick, traveler or some other type of hoisting and handling apparatus, to shift the hammer from pile to pile. The smaller sizes of the air hammers can be handled readily by one or two men. Drop hammers drive much more slowly than air hammers, except in very hard ground, are more likely to batter or bend the piles and require heavy leads that have to be supported by some kind of a tower or traveler, which are unnecessary for steam or air hammers. The use of a water jet, even under city pressure only, greatly facilitates driving in many kinds of soil, especially in sand, but is useless in clay.

In the reconstruction of the Greene Avenue sewer, Brooklyn, a trench 25 feet deep in dry sand was sheeted with 2 x 10-inch square-edge wooden sheet piles assembled in successive groups of ten or fifteen units set in trenches about 18 inches wide and 2 feet deep cut through the pavement on each side of the sewer. No outside rangers were used, but the inside rangers of the upper tier were framed together with cross braces and laid in the bottom of the trenches with just clearance enough on their outer faces to receive the sheet piles between them and the cut edges of the pavement. The sheet piles were driven by a McKiernan-Terry air hammer operated at first by men working on scaffolds about 7 or 8 feet high on each side of the trench. The piles were driven simultaneous with the excavation of the



DRIVING CORRUGATED PILES WITH HAMMER IN LEADS SUSPENDED FROM GIN POLE trench, the bottoms of the piles always penetrating a foot or two below the bottom of the trench.

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*Part 1. Wood and steel sheet piles, driven by hand and bracing, was published December 18.

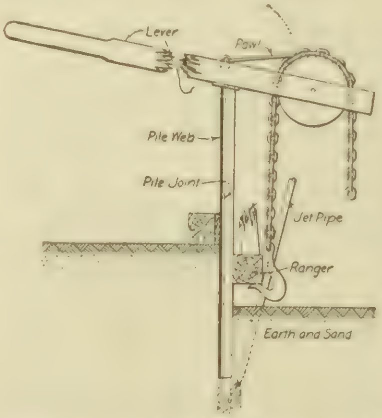
The large twin sewer on Ocean avenue was built in a trench excavated to a depth of 14 feet in sandy soil with ground water 5 feet below the surface. This trench was sheeted with 2 x 10-inch planks 16 feet long spaced 1 inch apart in the clear to permit free drainage of the ground water to channels left in the bottom of the trench on each side of the sewer, which conducted the heavy flow to the sump and kept the bottom dry enough to work on and support the construction. The sheet-pile units were assembled against the vertical face of the trench after the latter had been excavated 2 or 3 feet deep and single lines of rangers had been laid in the bottom and braced across the excavation to the rangers on the opposite side. The piles were driven a foot or two at a time by an air hammer working from end to end of a group, as the excavation progressed adjacent to them. The air hammer was assisted by a ½-inch jet of water under city pressure of 60 or 70 pounds. Excavation was made partly by hand at the beginning, but chiefly by clam-shell buckets operated by a traveling derrick. In this case and in the Greene Avenue sewer it would probably have been possible to drive the piles by hand with heavy mauls, but the work would have been slower and more costly.

DRIVING TRENCH PILES WITH STEAM HAMMER SUSPENDED FROM GANTRY

DRIVING WIDE, THIN PILES WITH A LEVER

A very convenient and expeditious method of driving by hand piles penetrating 5 to 10 feet in sand was used for a job in Brooklyn where the lever was fulcrumed on top of the unit to be driven. The short arm of the lever was provided with a sheave engaging the bight of a short length of chain with a hook at one end. The chain could be instantly fixed securely in any position on the sheave by means of a pawl attached to the lever and engaging one of the links of the chain.

The lever was raised to depress the sheave and permit the hook to engage the ranger, securely braced in position. Depressing the long arm of the lever forced the pile down several inches every stroke, the chain was quickly shortened and the operation was rapidly repeated until the pile was driven to the required penetration by the use of this lever combined with the use of a hydraulic jet operated at the foot of the pile. By this method slip-joint piles up to 20 inches wide were driven at the rate of 1,000 square feet per day by two men operating the lever and one man operating the hydraulic jet at about 80 pounds pressure.



DRIVING WIDE STEEL SHEET PILES WITH HAND LEVER AND WATER JET

Obviously, by operating the lever on an independent fulcrum placed on the opposite side of the pile-web, the method shown in the engraving can be used equally well for pulling the piles, the water jet in that case probably not being required.

PULLING PILES

Sheet piles that have only been driven to a moderate penetration in ordinary soil can generally be pulled by lever or tackle in less than one-half the time required for driving them. If they have been installed by the aid of a derrick, gantry or other traveler, a tackle suspended from the latter may be advantageously attached to the pile and operated by hand or by a hoisting engine. A hole is usually made through the top of the pile-web providing for a bolted connection to the pulling aparatus. If this is not the case, a chain, yoke or other cramping device may generally be slipped over the pile, and grip it tight enough to hold when it is subjected to an eccentric pull by the hoisting apparatus.

If great difficulty is experienced in starting to pull the pile it may often be remedied by driving the pile a few inches deeper to destroy the adhesion of the ground.

Piles are frequently pulled in successive short steps by means of a long hand lever connected at the extremity of the short end to the pile and operated on a fulcrum close to the pile. Generally a pile pulls much easier after it has started and although it may take considerable force to begin with, it may afterwards be lifted out by hand or be hauled out by a single line operated by the windless or hoisting engine. If it starts with great difficulty it may almost always be handled by a screwjack or hydraulic jack, after which other less powerful methods will remove it more rapidly.

The manufacturers of steel sheet piles have made special clamps with eccentric compression jaws or bearings that grip the pile-web tighter the stronger the pull on them. These are seldom needed for light or short piles but are suggestive of simple devices by which connections can easily be made to the pulling tackle when no pulling holes are provided in the pile webs.

STRAIGHTENING AND SPLICING

For most trench work, unless the driving is very bad, wood sheet piles 2 inches thick, if pulled, can be redriven two or three times, the ends being cut off a foot or two if damaged, and the splined joints on thicker piles repaired as necessary; tongue-and-groove joints cannot be repaired. In city streets it is sometimes necessary to leave them permanently in place to minimize settlement of adjacent ground.

Under favorable conditions, steel sheet piles should endure ordinary driving ten times or more with careful repairs, and if they are driven in very soft, free soil or with driving bars that protect the heads and points, they should endure four times as many drivings. If they are bent, they can usually be straightened by use of a jack, or crow, or by loading or by hot or cold sledging. Distorted interlocks are harder to repair, but may sometimes be improved so as to be usable. If the lower ends are very badly bent or battered by boulders or other obstructions they will be very hard to pull, and if pulled may not be worth repairing. Sometimes under such circumstances a few feet can be cut off from either end and one piece saved and the other scrapped. Sheet steel piles can be cut easily with a cold chisel or hack saw. Rolled sections need a saw or oxy-acetylene torch; and the torch, if available, is best, quickest and cheapest for cutting all steel piles.

When the required penetration is greater than the length of the piles provided, the piles may be driven in successive tiers or they may be spliced to required length. For trenches carried down a few feet below ground-water level it is sometimes convenient to sheet with wooden piles down to water level and below that elevation with steel piles that are stronger, have tighter joints and can be much more easily driven in advance of the excavation.

Steel piles are usually spliced by fish plates or single or double web cover plates covering butt joints, and bolted on in the field. Slip joint piles can be cheaply and efficiently spliced by wooden planks. When all the piles are spliced it is best to locate the splices 2 feet or more from the middle of the pile and reverse the position in adjacent units or otherwise vary the distance of successive joints from the pile tops so as to get a staggered line of joints.

PULLING STEEL SHEET PILES WITH TACKLES SUSPENDED FROM GANTRY AND OPERATED BY HAND WINDLASS

A Labor Incident

We are informed by a contractor doing work in a large city in one of the south Atlantic states that up to a few weeks ago he was paying ordinary labor (and exceedingly ordinary, he stated) $.60 an hour. Two or three weeks ago he discharged all of this labor and advertised in the local papers for labor at wages of $.25 an hour. Inside of a week all of his old gang except one had returned to work at the lower wage. "And you ought to see those babies work," he said. "If they had worked as hard when I was paying them $.60 an hour as they do now at $.25, I would gladly have paid them a dollar an hour had they asked it."

Possibly this experience could not have occurred in exactly this way or the reduction been made to so great an extent in a northern city, but indications are that conditions similar to those that made this reduction possible are becoming increasingly common and influential in most sections of the country.

$400,000,000 More Federal Aid for Roads

A delegation of state highway commissioners has urged Congress to pass the McArthur bill appropriating $400,000,000 for aiding road construction, now that the original $275,000,000 had all been allotted, $100,000,000 being allotted annually for four years. Every state except Washington was represented in the [illegible]

Recent Legal Decisions

CITY ORDINANCE REQUIRING LICENSING OF ELEVATOR OPERATORS HELD VALID

The California District Court of Appeals holds, Ex parte Stone, 192 Pac. 71, that an ordinance (of the city of Los Angeles) requiring operators of elevators to procure a license from the board of mechanical engineers, does not conflict with a provision of the charter giving the board of public works charge of ordinances regulating the use and operation of mechanical appliances in buildings, since the licensing of operators is not a regulation of the use and operation.

CITY'S POWER TO PROVIDE FOR WATERWORKS SYSTEM BY CONTRACTING FOR DAM AND LEASING SURPLUS WATER POWER

In 1876 the city of Eau Claire, Wis., being desirous to obtain water power for municipal waterworks, secured the passage of an act empowering the city to build a dam not to exceed 16 feet in height across the Chippewa river. The city made a contract with an improvement company, giving it a lease of the dam and surplus water power. The company now sues to restrain the city from declaring a forfeiture of the lease. The Wisconsin Supreme Court holds, Eau Claire Dells Improvement Co. v. Eau Claire, 179 N. W. 2, that the main purpose of the act of 1876 was to provide a waterworks system for the city, and in operating such a system a city acts in a proprietary and not in a governmental capacity. Acting in such a capacity, it may, generally speaking, exercise such powers as a private concern engaged in a like business may exercise; for in their business matters municipal corporations are governed by very much the same rules as private corporations. Therefore, wholly irrespective of direct legislative authority, the city could contract to have another build and operate the dam for waterworks purposes. Not having the funds itself, it could lawfully contract with the improvement company to furnish the same and secure the latter for its reimbursement by a lease of the dam and so much of the water power as the city did not need for its purpose. It was specially authorized to lease the excess water power for manufacturing purposes. This provision of the act was no doubt induced by the fact that such leasing, except as an incident to a municipal purpose, is not within the scope of a municipality. So also special provision was made for authority to lease such piers, booms and other structures as shall be sufficient for protecting and preserving the navigability of the river. If the dam was constructed, these would be a necessary incident thereto in order to preserve the public right of navigation, and so special grant to transmit the discharge of such public duties to lessees was secured. Therefore, it was held that no duties devolving upon the city had been unlawfully delegated to the improvement company and the city had authority to lease the dam. It was also held that provisions in the lower court's decree enjoining the city from forfeiting the lease for acts which it was estopped to question so long as the state did not compel their discontinuance (the building of a mill over the lock and flashboards raising the water above the specified height) were objectionable, as permitting a forfeiture by the city for past acts in case the state should declare them unlawful, and should be modified to permit forfeiture only for the continuance of the acts after they were declared unlawful.

RECOVERY BY PEDESTRIAN INJURED BY HIDDEN DANGER IN UNIMPROVED PART OF STREET

A catch-basin which had been excavated by a city several years before in connection with a proposed sewerage system had been covered over with boards on which earth had been strewn. The catch basin was situated at the side of a street at which there was no sidewalk, and was 3 or 4 feet deep and some 2 or 3 feet in diameter. The boards had become decayed and broke under the weight of a pedestrian, who fell into the catch-basin, sustaining injuries for which she sued the city. A verdict for the plaintiff was set aside by the trial court. The Supreme Court of Appeals of West Virginia has reinstated the verdict and rendered judgment for the plaintiff. Garr v. City of McMechem, 104 S. E. 101. It is held that while the authorities of a municipal corporation, in the exercise of a proper discretion, may determine not to pave or improve the entire surface of one of the public streets, yet the public have a right to use the unimproved part thereof; and if such unimproved part is rendered dangerous for use in the ordinary way, by secret or hidden perils created therein by the municipality itself, one injured by reason thereof will be entitled to recover damages for such injuries.

CONSTRUCTION OF COUNTY'S ORDER AS TO ROAD WORK

A county court made the following order: "It appearing to the court that all the funds available for the construction of roads have been exhausted, it is ordered that all work on all the roads heretofore contracted be suspended, and the various engineers in the employ of the county are directed to proceed at once to measure and make up at once a final estimate on all such roads except the road from Pineville to Oceana." This notice was served on all road contractors doing work for the county, including the contractor for the Pineville-Oceana road. That contractor discontinued work. Subsequently another order was made containing a direction that he carry out his contract and he was notified he would be paid on completion. The Circuit Court of Appeals, Fourth Circuit holds, Winston v. Wyoming County Court, 266 Fed. 686, that the contractor was justified in discontinuing work on the first order, and that the second order was of no effect, and he was held entitled to decree for the amount due under the contract for the work already done.

NEWS OF THE SOCIETIES

Dec. 21 — ENGINEERS' CLUB OF PHILADELPHIA. Regular business meeting. Subject "Road Congestion for Heavy Truck Traffic." Club-house, 8.15.

Dec. 27-Jan. 1 — AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Smithsonian Institute, Washington, D. C. Chicago, Ill.

Dec. 28-31 — AMERICAN ECONOMIC ASSOCIATION. Yale Station, New Haven, Conn. Atlantic City, N. J.

Jan. 18 — WATER POWER LEAGUE OF AMERICA. First annual meeting. Engineering Societies' Building, New York City.

Jan. 19 — INTERNATIONAL CUT STONE CONTRACTORS' AND QUARRYMEN'S ASSOCIATION, Inc. Annual meeting. Congress Hotel, Chicago, Ill.

Jan. 19 — AMERICAN SOCIETY CIVIL ENGINEERS. New York City.

Jan. 25-27 — CANADIAN NATIONAL CITY PRODUCTS ASSOCIATION. 19th annual convention. Carls-Rite Hotel, Toronto.

Jan. 25-27 — THE AMERICAN WOOD PRESERVERS ASSOCIATION. Place of meeting to be announced later.

Jan. 25, 26, 27 — ASSOCIATED GENERAL CONTRACTORS. Annual meeting, New Orleans. Secretary's Office, Washington, D. C.

Jan. 31-Feb. 5 — NATIONAL BRICK MANUFACTURERS' ASSOCIATION AND COMMON BRICK MANUFACTURERS' ASSOCIATION OF AMERICA. Joint meeting. Hotel Pennsylvania, New York City.

Feb. 1-2 — NEW YORK STATE ASSOCIATION OF BUILDERS. Convention. Rochester, N. Y.

Feb. 1, 2, 3—ONTARIO PROFESSIONAL MEETING in conjunction with the annual meeting of the Engineering Institute of Canada. Toronto.

Feb. 9-12 — AMERICAN ROAD BUILDERS' ASSOCIATION. Eighteenth annual convention, eleventh American Good Roads Congress and twelfth National Good Roads Show, Coliseum, Chicago, Ill.

May 17-19—NATIONAL FIREMEN'S ASSOCIATION. Twenty-third annual convention. Fort Wayne, Ind.

June 7-9—NATIONAL FIRE PROTECTION ASSOCIATION. Annual meeting. San Francisco, Cal.

June—CONFERENCE OF MAYORS AND OTHER CITY OFFICIALS, State of N. Y. 12th Annual Conference. Elmira, N. Y.

June 6-10, 1921—AMERICAN WATER WORKS ASSOCIATION. Annual convention at Cleveland, Ohio. Secretary, J. M. Diven, 153 West 71st St., New York.

AMERICAN SOCIETY OF CIVIL ENGINEERS, NEW YORK SECTION

A regular meeting of the New York section of the American Society of Civil Engineers was held on December 15 at the Engineering Societies Building, New York City. The subject for discussion, introduced by B. F. Cresson, Jr., consulting engineer, New York-New Jersey Port and Harbor Development Commission, was "The Port of New York." Those participating in the discussion were: F. W. Cowie, chief engineer, Harbor Commissioners of Montreal, Canada; F. M. Williams, state engineer, New York; John Meigs, consulting engineer, Philadelphia, Pa.; Capt. F. T. Chambers, chief engineer, Port Facilities Commission, U. S. Shipping Board; E. P. Goodrich, consulting engineer, New York City; J. Spencer Smith, chairman, Board of Commerce and Navigation, New Jersey; J. J. Mantell, terminal manager, New York Region, during Federal Administration; George S. Webster, chief engineer, Department of Public Works, Philadelphia, Pa., Julius Henry Cohen, counsel, New York-New Jersey Port and Harbor Development Commission; William M. Calder, U. S. Senator; and Murray Hurlbert, Commissioner of Docks, New York. Communications were also read from A. W. , Robinson, mechanical engineer Montreal, Canada; G. F. Nicholson, chief engineer, Port of Seattle, Wash.; and G. B. Hegardt, engineer, Commission of Public Docks, Portland, Ore.

TWELFTH NATIONAL GOOD ROADS SHOW

Road building machinery, road materials and highway transportation equipment will be exhibited at the Twelfth National Good Roads Show, which will be held this winter on February 9 to 12, 1921, at the Coliseum in Chicago. Chicago was chosen because of its central location and the splendid facilities afforded by the Coliseum for a good show. The Exposition will be one of the main features of the Eleventh American Good Roads Congress, to be held in Chicago at that time in conjunction with the Eighteenth Annual Convention of the American Road Builders' Association, an organization of the public highway officials and road machinery, road materials and highway transportation men of the United States and Canada.

Delegates from more than one thousand American and Canadian cities are expected to attend the Congress and visit the Exposition. These representatives are are to be appointed by the governors of states and mayors of cities, who in some instances will head their own delegations. Officials of highway departments of government, states, counties, and cities all over the United States, and from Cuba, Porto Rico, Hawaii and Alaska will visit the exposition, together with road, automotive and chemical engineers, contractors, agriculturists, motorists and large users of trucks, tractors and other highway transportation equipment.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, SECTION MEETINGS

On December 17, the Boston section of the A. S. M. E. had a joint meeting with the Boston Society of Civil Engineers. The subject for discussion was "Water Powers of New England," by H. K. Barrows, consulting engineer, Boston, Mass., and W. S. Murray, consulting engineer, New York City.

Future meetings are: The Hartford branch, Connecticut section, on January 10, at the City Club, which will be addressel by C. L. Lesher, editor of *Coal Age;* the Toledo section, on January 11, at the Toledo Commerce Club, at which meeting Dr. Quillan, of Toledo University will speak on "The Neews of Business Training in Engineering"; the Columbus section, on January 11, at the Engineers' Club, Southern Hotel, at which will be considered "The Story of Petroleum," with motion pictures from the Bureau of Mines; the Atlanta section, holding a joint meeting with the Atlanta section of the A. S. C. E., on January 25, in the Carnegie Library, at which time B. M. Hall, of the George Railway & Power Co., Atlanta, Ga., will speak on "Water Power Development"; the Philadelphia section, on January 25, at the Engineers' Club of Philadelphia, which organization will be addressed by Julian S. Simsohn, chemical engineer; and the Colorado section, on January 28, at the Metropole Hotel, at which meeting Charles C. Gates, president of the Gates Rubber Co., will speak on the "Industrial Expansion of Colorado."

AMERICAN ASSOCIATION OF ENGINEERS

The Board of Directors of the Association has appointed a Committee on Water Power and Conservation, headed by Dr. F. H. Newell, who will be supported by Edmund T. Perkins, president of the Edmund T. Perkins Engineering Co., of Chicago; Charles E. Waddell, consulting engineer of Asheville, N. C.; L. F. Harza, hydro-electric engineer of Chicago; H. A. Allen, consulting engineer of Chicago; and J. B. Lippincott, of Los Angeles.

A proposed license law for engineers and land surveyors which will be introduced before the next legislature for adoption has been printed and distributed by the Montana Assembly of the American Association of Engineers.

The Great Northern Railway Section of the Association has been asked by G. R. Martin, executive vice-president of the Great Northern Railway, and A. H. Hogeland, chief engineer, to assist in outlining and developing an educational program for employees of that railroad. Plans are now being worked out by the executive committee of the section, to which Professor Frederic Bass of the University of Minnesota, chairman of the A. A. E. Committee on Education, is acting in an advisory capacity.

A Tennessee State Assembly of the American Association of Engineers was formed at a meeting which was held in Nashville on December 4, composed of representatives from the Memphis, Chattanooga, Knoxville and Nashville chapters of the association. It was decided by these delegates to present a joint bill to the next legislature licensing both engineers and architects.

The results of the membership campaign recently conducted by the A. A. E. show that more applications were received during the drive, lasting from September 15 to October 30, than the association had members twenty-two months ago. Moreover, many more than the usual number of applications have come in since the campaign due to the interest created by the drive. The total number of applications received in the campaign was 3,735, and the total membership on January 18, 1919, was only 3,735. A. A. E. is now almost as large as any two technical societies in the country. It has now 240 chapters and clubs and has offices in thirteen cities, New York, Washington, Pittsburgh, Boston, Detroit, St. Louis, St. Paul, Omaha, El Paso, San Francisco, Los Angeles, Seattle and Portland. It has state assemblies in ten states: Nebraska, Montana, Ohio, Washington, California, Washington, North Carolina, Illinois, Arizona and Tennessee. State chapters have been established in Nevada, North Dakota, South Dakota, Minnesota, Idaho and Oregon.

The St. Louis chapter has opened an office in the Columbia building as the first step in its campaign to increase its membership to six hundred and its income to 60 per cent of the receipts from members in its jurisdiction.

THE ASSOCIATED GENERAL CONTRACTORS

"Contracts" and "Insurance" will be the principal topics for discussion at the annual meeting in New Orleans, January 25, 26, 27, 1921. Legislation, Transportation, Finance, and Closed and Open Shops will also be given special attention.

Three general sessions of the whole association will be held and two sessions will be given over to meetings of the four Members' Divisions, viz.; Highway, building, railroads, and public works contractors. An afternoon on the Mississippi, a smoker, a theater party and the annual dinner, together with a variety of entertainment are planned by the New Orleans chapter.

MONCTON BRANCH OF THE ENGINEERING INSTITUTE OF CANADA

Engineers of Moncton, N. B., have formed a branch of the Engineering Institute of Canada, with William A. Duff, assistant chief engineer, Canadian Government Railways, as chairman, J. D. McBeath as vice-chairman, and M. J. Murphy as secretary-treasurer.

AMERICAN SOCIETY OF CIVIL ENGINEERS

The American Society of Civil Engineers has established by "declaration" a full ticket of candidates for office in opposition to the one selected by the nominating committee. The following men have been nominated: As president, J. Waldo Smith, chief engineer, Board of Water Supply of the city of New York; as vice-president, Allen Hazen, consulting engineer, New York City, and Frank G. Jonah, chief engineer, Frisco Lines, St. Louis, Mo.; as treasurer, Arthur S. Tuttle, deputy chief engineer, Board of Estimate and Apportionment, New York city; and as directors, for district 1, John P. Hogan and Robert S. Parsons; for district 4, Harry A. Lane and Alexander Maitland, Jr.; for district 10, F. T. Darrow; and for district 11, Richard D. Parker.

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS

The annual convention of the American Association of State Highway Officials was held at the Washington Hotel, December 13 to 16, inclusive, with a large attendance from a membership which includes the executives and principal engineers of all state highway departments. The improvement of methods for the construction of Federal-aid roads formed one of the major topics for discussion. Secretary of Agriculture Meredith, who administers the Federal-aid road law, discussed future policies in the co-operative building of a system of highways that will serve adequately the constantly increasing transportation needs of the country.

Thomas H. McDonald, chief of the Bureau of Public Roads, which has direct supervision of the construction of Federal-aid roads, addressed the convention on "What Has Been Accomplished under Federal Aid."

Daniel Willard, president of the Baltimore & Ohio Railroad, spoke on "What May the Highway Departments Expect from the Railroads in 1921 in the Matter of Transportation of Road-Building Materials?" In view of the fact that the shortage of freight cars has been the principal limitation upon the highway work of the past season, Mr. Willard's address had an important bearing on the plans which will be made for next year's road work.

Colored photographs of Federal-aid highways in all parts of the country had been prepared by the Bureau of Public Roads and were exhibited on the top floor of the Washington Hotel.

The officers of the American Association of State Highway Officials are: Paul D. Sargent, president, chief engineer, State Highway Commission of Maine; W. S. Keller, vice-president, state highway engineer of Alabama; John H. Mullen, treasurer, deputy commissioner of highways and chief engineer, Minnesota; Joseph Hyde Pratt, secretary, Chapel Hill, North Carolina.

CITY MANAGERS' ASSOCIATION

The seventh annual meeting of the City Managers' Association took place at Cincinnati, Ohio, on November 15-17. Discussions were held on the following subjects: "A Model Paving Program for a City of Twenty Thousand," "Practical Budget Procedure," "Setting Up a City Plan Program," "Building a Fundamental First Step in City Planning," "City Planning Achievements in the United States," "Making City-Owned Utilities Pay," and "The Relation of Motor Trucks to City Business."

The new officers elected at the meeting were: President, A. W. D. Hall; first vice-president, George M. Zimmerman; second vice-president, Edwin J. Fort; third vice-president, Wilder M. Rich; and executive secretary, Harrison G. Otis.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK SECTION

A meeting of the New York section of the American Institute of Electrical Engineers was held on December 15 at the Engineering Societies' Building. The subject of the meeting was "The Port of New York," introduced by B. F. Cresson, consulting engineer, New York-New Jersey Port and Harbor Development Commission.

PERSONALS

VanLeyen, Schilling, Keogh & Reynolds, architects and engineers, formerly at 201 Walsh Bldg., Flint, Mich., have changed their address to 413 Genessee County Savings Bank Bldg. cated at Charles City, Iowa.

Inman, A. W., superintendent of the Massillon, Ohio, Water Company, has resigned, retaining his directorship in the company. Mr. Inman is treasurer of the Central States Section of the American Water Works Association.

Kenny, G. R., formerly statistician and valuation engineer for the San Joaquin Light & Power Corporation, is now with Ford, Bacon & Davis, in valution, report and special investigation work.

Smith, R. R. Ress, county surveyor, has been appointed highway engineer of Sonoma county, California.

Adler, Julius, has been appointed deputy chief of the division of highways of the Bureau of Highways and Street Cleaning, Philadelphia, Pa.

Massie, G. C., of Lynchburg, Va., has been elected president of the new state board, which was organized on November 5 for the examination and certification of professional engineers, architects and land surveyors.

Fuller, C. H. R., has been appointed city engineer of Chatham, Ont., Canada.

Howe, S. B., has been reappointed city engineer of Sioux Falls, S. D.

Freed, Joshua, B. F., for a number of years chief engineer for the old sewer commission of Louisville, Ky., has been appointed chief engineer of the new sewer commission of that city.

Winslow, Professor C. E. A., of Yale University, an expert in sewage disposal work, has been granted a five months' leave of absence from university duties to direct public health work of the League of Red Cross Societies in Europe.

Faherty, M. J., president of the Chicago board of local improvements, has been elected president of the American Road Building Association.

J. H. Thomas, general secretary of the National Union of Railwaymen, was elected president of the International Federation of Trades Unions at London on November 23.

Curtin, Daniel A., civil engineer, died in New York November 4.

Benton, John B., died in Union Springs, N. Y., November 5. Mr. Benton was a division engineer on the construction of the Erie canal, and was president of the Benton Manufac-

Tait, Harold, engineer in charge of the Bureau of Sewers of Queens Borough, New York, died November 29 of pneumonia. He was appointed to the Bureau of Sewers in 1889 and made engineer in charge in 1910.

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

DUFF JACK No. 339

A new model of 15-ton single acting ratchet jack has recently been put on the market by the Duff Manufacturing Co. This jack, which is known as No. 339, while particularly adapted for bridge work, has a height of 22 inches, raise of 11½ inches and capacity suitable for general use by contractors.

Easy operation is secured by the use of a large number of small teeth on the lifting rack. This decreases the amount of raise per lever stroke, but the effort required on the lever is reduced so greatly that more strokes can be taken in the same time. Hence the lift is very rapid. When in mesh with the rack, the pawls push straight up, doing away with side thrust and reducing wasteful friction between the rack and the rack channel.

Duff jack No. 339 has been strengthened at every point where long experience has found it to be desirable. The lifting rack is of forged steel, heat-treated, with an exceptionally large rectangular cross-section to provide stiffness. Double-pointed pawls distribute the lifting pressure evenly between two of the rack teeth so that each tooth carries only one-half the load. The socket lever is a one-piece steel casting. The use of heavy fulcrum trunnions, cast integral with the socket lever, does away with the fulcrum pin hole which weakens the socket lever at a point subject to heavy strains. The base has reinforcing ribs both front and back which provide maximum strength with minimum weight. Closed end, refillable, grease packed bushings keep out grit and protect the trunnions against wear by affording perfect lubrication.

15 TON RATCHET JACK FOR BRIDGE BUILDING AND GENERAL CONSTRUCTION WORK

The Duff Manufacturing Co. is distributing Catalog No. 104, a new 148-page book, illustrating and describing the complete line of Duff lifting jacks. It includes jacks of all types used by contractors—track jacks, bridge jacks, pipe-forcing jacks, motor truck jacks and trench braces.

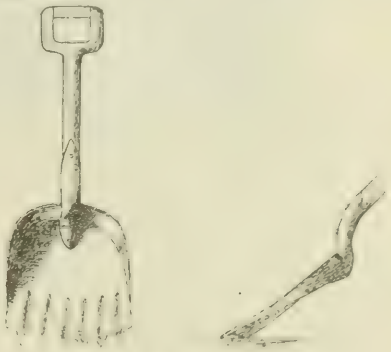
FABRICATED AND WELDED STEEL

The Fabricated Steel Products Corporation manufactures a large line of riveted steel articles for various mechanical and industrial operations as well as for construction work, which includes clam-shell buckets, dredge pipe, steam boilers and pontoons, steel dredges, trusses, columns, beams and girders, mine cars, structural steel buildings, bins, tanks and miscellaneous and special steel work. It is also prepared to weld any thickness of steel, cast iron or other metal by the electric process and to sell plates, shapes and boiler tubes.

Standard circular storage tanks are made up to a diameter [illegible] a capacity of 217,000 gallons, cylindrical pressure tanks with diameters up to 10 feet and a capacity of 17,500 gallons, steel chimneys of diameters up to 144 inches and heights of 300 feet, cast or riveted steel pipe of any kind and any diameter, boilers, car tanks, water towers, coal bunkers and other articles of a similar nature.

KAPPERTZ SNOW SHOVEL

An improved shovel or plow for the removal of hard snow and ice has been designed by Leo Kappertz, 95 Washington street, Morristown, N. J. The shovel has teeth formed integral with the cutting edge, and of different lengths arranged so as to successively engage the different layers of ice or snow and work them apart, while they also provide a fulcrum in the rear to guide the shovel and give it greater efficiency.



IMPROVED SNOW SHOVEL

A similar effect, intended to resemble the action of hand shoveling, is thought to be obtained by riveting teeth to the lower front edge of a sheet-metal scraper, resembling a locomotive cow-catcher, which is arranged to be installed on the front end of a street car or truck.

INDEPENDENT CONCRETE PIPE

Reinforced concrete pipe for sewers, conduits, water-lines, drainage, culverts, or irrigation is the subject of Bulletin No. 9, published by the Independent Concrete Pipe Company, which designs and supervises and provides for the construction and installation of such pipes. It ships complete equipment for the manufacture of the pipe to the required locality and sends there a competent superintendent under whom the pipe is constructed and installed by local labor and so far as possible with local materials.

The pipe, which is reinforced near the inner and outer surfaces with triangle mesh, is made in regular sizes of 24 to 96-inch diameter with walls 5½ to 9 inches thick and in lengths of 4 feet. The hub and spigot joints are made in the regular thickness of the pipe with special design by which the invert is accessible from the interior and the arch portion of the joints [illegible] exterior [illegible].

KOEHRING ROTARY GRADER

The Koehring rotary grader advances under its own power, grading the road bed and elevating and loading the soil to cars alongside at the rate of 60 to 100 cubic yards per hour.

Excavating is done by a revolving cylinder that carries twelve herringbone-shaped buckets with rooting teeth. The buckets dump the spoil on the conveyor belt at right angles to the machine that discharges on either side into wagons, trucks or cars. The machine is adjustable to make cuts 5½ feet wide and 1 inch to 2 feet deep at either of four speeds selected according to conditions of operation. The machine is mounted on separately controlled caterpillars giving it a very short turning radius and is capable of excavating the material and loading 2-yard wagons for 1½ cents per yard.

At present the machine is not carried in stock, but is built strictly to order. The machine, including the 45 h. p., four-cylinder, four-cycle vertical gas engine, weighs 47,000 pounds, is 11 feet 9½ inches high, 32 feet 6 inches long and 10 feet wide with conveyor folded. It can be provided with a screen attachment to separate macadam stone from dirt in the spoil.

ROTARY GRADER REMOVING OLD MACADAM AND GRADING FOR NEW PAVEMENT IN BALTIMORE

NORTHWEST CRANES

Revolving cranes manufactured by the Northwest Engineering Works are mounted on improved crawler tractions with special steering methods and are recommended for handling stone, coal or other materials; for loading, unloading, storage and reclaiming.

This crane has a great advantage in its ability to mount the storage pile, thus greatly increasing its scope and lift. The crane steers easily, has simple and durable mechanism, does not require guide wheels or adjustment, is fitted with two independently operated hoist drums that hoist and swing simultaneously; has all machinery located on the opposite side of the pivot from the load so as to act as a maximum counterweight, does not require outriggers, jacks or stabilizers, and can be equipped to generate its own current for electric lift magnet.

When equipped with a 30-foot boom and crawler type wheels, and working on a level base, it has a lifting capacity varying from 10,000 pounds on a 12-foot radius to 5,200 pounds at a 30-foot radius. It has a maximum single line pull of 11,000 pounds, hoisting speed on single line of 140 feet per minute, rotating speed 3 r. p. m., travel speed 100 feet per minute and can turn on a 35-foot radius. For handling sand and other heavy materials a ¾-yard bucket is recommended and for lighter materials such as coal, a 1-yard bucket.

CRANE CLIMBING STORAGE PILE THAT IT BUILDS

INDUSTRIAL NOTES

The interest manifested in the coming exposition to be held at the Twelfth National Good Roads Show at the Coliseum in Chicago, February 9 to 12 next, is most unusual. More than four thousand square feet of floor space in the big exposition hall will be devoted to the exhibits, which, owing to the tremendous increase in road building and street improvement work since the close of the war, promise to exceed in number and variety those of the expositions held at Boston, Pittsburgh and Chicago before the war.

Many types of road-building machinery and highway transportation equipment will be shown, and the use of road-building materials, through improved methods and under improved conditions, will be specially demonstrated.

Power for the operation of machinery will be furnished by the Coliseum Company. In order that everything may be in readiness for opening the show at 9 a. m. Wednesday, February 9, the installation of exhibits will begin on **February 7.**

NEW YORK TRANSPORTATION SHOW

Approximately 22,000 square feet out of the 23,000 square feet available for motor truck exhibits at the Highway Transportation Show to be held in New York from January 3 to 8, 1921, were drawn for November 18 at the New York offices of the Motor Truck Association of America, under whose auspices the show will be held.

The representatives of twenty of the most prominent makes of trucks were at the drawing, which was made by lot—those contracting for the greatest amount of space having the first choice.

Although many other makes of trucks will be exhibited, space for only those makes whose representatives had contracted and paid for exhibition space were allowed to participate in the drawing. The makes of trucks included in the drawing were: Atterbury, Bessemer, Brockway, Clinton, Federal, Gramm-Bernstein, Indiana, Jumbo, Kelly-Springfield, Moline, Nash, Perker, Rainier, Reo, Riker, Selden, Service, Transport, Vim, Ward-La France and Highway Trailer.

The show, at which the above makes of trucks will be exhibited, will be more in the nature of a highway transportation show than a mere motor truck show. For the first time in the history of motor truck exhibitions, the show will be held by a users' organization instead of a dealers' or manufacturers' association. While the show will be held by this users' organization, the details of the show itself will be supervised by a committee of the dealers' division of the Motor Truck Association.

5 per cent sewer bonds to the amount of $50,000.

N. Y., S. I., St. George—C. D. Van Name, pres. Richmond Boro, received bids Dec. 7, building sewer in South st. from Long Island R. R. tracks to Rockaway avenue, (a) open cut, (b) tunnel, from L. Spagnolia (a) $[illegible], (b) $[illegible]; Green Contg. Co., 31 Vernon avenue, Astoria, L. I., (a) $[illegible]; J. Pottitan (a) $[illegible], (b) $[illegible].

O., Youngstown—City proposes to build 1 1-2 miles addition to Mill Creek sewer at a cost of $[illegible]. C. F. Farmer, city hall.

O., Columbus—City council passed a resolution to construct a sanitary sewer in Ebony street. Opha Moore, clerk.

O., Cincinnati—City council plans several sewer improvements, including the installation of sewers in Madisonville.

O., Columbus—City Engineer Simpson estimates sewer program in 1921 to cost $[illegible].

O., Zanesville—A motion to prepare an estimate on a storm and sanitary sewer on [illegible] street, from Cliffwood avenue to Fifth street was passed by city council. An ordinance authorizing a bond issue amounting to $1[illegible],000 was passed for the purpose of paying the city's proportion for the construction of the sanitary sewer in the 4th ward, was passed by the council.

O., Cincinnati, has authorized $36,700 Sewer bonds.

O., Van Wert—Bids will be asked in the spring for a sewage disposal plant. The consulting engineer is James Sloop, City Hall.

O., Alliance—The construction of a sanitary sewer in Rockhill Av. is under contemplation. H. E. Anderson is engineer and C. P. Silver, Court House, Canton, O., is county auditor.

O., Akron—Legislation to sell $200,000 paving bonds, sewer and water bonds, is now before the finance committee of the council. The committee has already recommended $200,000 for resurfacing and paving streets and will issue its further recommendations this week.

Okla., Norman—City having plans prepared for extending sewerage system. About $50,000. Peckham, Sutton & James, Oklahoma City, engrs.

Ont., St. Thomas—The Board of Works Committee plans to start work at once for the construction of two sanitary sewers.

Pa., Harrisburg—An ordinance to provide for two new sewers introduced in City Council.

Pa., Scranton—Dept. Public Works receives bids in spring, building lateral sewers, involving 3,550 lin. feet. 8-12 in. vitr. pipe sewer. About $27,701. W. A. Schunk, chief engineer.

Pa., Pottsville—Sewerage improvement is planned for this city.

Pa., South Bethlehem (P. O. New Bethlehem), has voted $3,500 Sewer bonds.

Pa., Susquehanna—Vote on Jan. 12 on $50,000 sewer and paving bonds.

S. D., Montrose—Vote waterworks and sewer bonds.

Tenn., Knoxville—Sewer improvements for this city, will require an expenditure of $500,000, according to Commissioner N. B. Kuhlman.

Tex., Fort Worth—Bids received from M. M. Purvis, The Tarrant Construction Co., and J. E. Wells, for installing sewerage disposal system. The work to cost approximately $5,000.

Tex., Breckenridge—Citizens voted for bonds to provide for the construction of sewerage system to cost $250,000.

Tex., Plainview, is considering voting on $100,000 Sewer bonds.

Tex., Dallas—Board of Commissioners ordered sanitary sewers to be laid in Rawlins street from Douglas to Wycliffe, at $931, and in Gilbert street, from Throckmorton to Herschel, at $2,712. A storm sewer will be constructed in Bennett street at a cost of about $5,000.

Tex., Houston—City council will issue bids for the construction of sewerage on Labranch street from Congress to Texas avenue, at $3,000.

Va., Ft. Monroe—War Dept. has asked an appropriation of $14,166 for the improvement of the sewerage system at Ft. Monroe.

Wis., Oshkosh, has authorized $45,000 Sewer bonds.

Wis., Two Rivers—City having plans prepared for building additional sanitary and storm sewers in various streets.

[illegible] & [illegible], [illegible] Grand Av., Milwaukee, engrs.

Wyo., Laramie—An election held recently resulted in favor of issuing the following bonds: Sewer, $16,000; Water, $[illegible].

WATER SUPPLY

Ariz., Phoenix—$1[illegible],000 extension and enlargement water distributing system bonds approved at recent election.

Ark., Conway—Extensions to water works contemplated. Town clerk.

Ark., Fort Smith, will offer $200,000 Waterworks bonds.

Ark., Booneville, is to vote on Waterworks and Sewerage System bonds.

Cal., Niland—Mutual Water Co. [illegible] is organizing additional water district to serve 6,000 acres between [illegible] and Wister. Work involves extension of main high line canal to Wister. Cost to exceed $100,000. C. Allison, Niland, engr.

Cal., Red Bluff—A bond issue for $140,000 approved at a recent election providing for purchase and development of the Antelope Creek Water Company.

Cal., Los Angeles—The Associated Supply Co., 72[illegible] S. Workman street, Los Angeles, awarded contract for furnishing 40,000 ft. 2-in. standard wrought black pipe to the Dept. of Public Service, at $22.20 per cu. ft.

Cal., Los Angeles—City Council approved the building of the proposed Pacoima dam for the purpose of increasing the water supply. Estimated cost about $1,500,000.

Cal., Sacramento—Contract for initial work necessary in developing of a 30-acre tract of land near Davis, recently acquired by the State as a site for a nursery will be let at once. The boring of a well to secure a water supply, building of new fences and leveling of the grounds will represent the first jobs to be undertaken at once. Buildings will be constructed later.

Cal., Sawtelle—The Railroad Commission recommended the installation of meters by the Crystal Spring Water Co. of Sawtelle to prevent wastage of water.

Eng., Hucknall—An extensive scheme for water supply is now maturing. Propose to construct a new reservoir to hold one million gallons.

Eng., Wigton—Rural District Council proposes to carry water to Bouness, Port Carlisle, Drumburgh, Easton and Glasson, at a cost of 6000 pounds.

Fla., Winona—City has voted $60,000 of 6 per cent serial 20-year bonds for purchasing water and light plant. J. O. Staples, mayor.

Fla., Pensacola—City commissioners have authorized laying 6-in. water mains on several streets.

Ga., Atlanta, is considering issuing $3,000,000 Water bonds.

Ia., Newton—City has plans prepared building rein.-conc. or steel reservoir, with 1,250,000 gal. capacity, 2 centrifugal pumps, pump house, 20-35 h.p. motor to pump 350,500 gal. per minute, etc. Work involves 1,000 cu. yd. concrete in reservoir and 3,250 cu. yd. earth excav. About $65,000. E. T. Archer, New England Bldg., Kansas City, Mo., engrs.

Ida., Parma—Board of trustees plan commencement next spring of new water system and modern drainage system. Question of raising funds to be submitted to voters.

Ida., Weiser—An election will be held Jan. 4 to vote the issuance of Water Works Extension bonds to the amount of $150,000.

Ill., Springfield—Plans and specifications are being prepared for iron removal and softening plant for the City of Springfield, Ill. Installation will be approximately 15,000,000 gal. capacity. Burns & McDonnell, consulting engineers, 402 Interstate Bldg., Kansas City, Mo.

Kans., Leavenworth—Carried by a vote of two to one recently, the city of Leavenworth, Kan., voted to take over the water works plant at the purchase price of $650,000. The appraisal for the city was made by Burns & McDonnell, consulting engineers of Kansas City, Mo.

Kans., Kansas City—Council authorized city controller to purchase $[illegible] worth of water works improvement bonds to be used for the improvement in the plant at the Quindaro Pumping station on the Kansas side.

Manila—According to Special Agent J. F. [illegible], the city of Manila is making plans for greatly enlarging its water system. For the purpose of carrying out the improvements, the metropolitan water district has been organized. It was recently decided to procure two or three experienced engineers in the United States to render the technical services required for this work, the completion of which will probably take seven years.

Mass., Beverly—The pumps at Beverly, Mass., were recently started pumping the water from the Ipswich river into Wenham Lake, the source of water supply of the city. According to the provisions of the act allowing the taking of water from the Ipswich River there must be over [illegible] gallons a day flowing before any can be pumped out.

Mass., Groveland—Town plans building water mains, cost to exceed $[illegible]. A. J. [illegible], clerk.

Mass., Boston—[illegible] Pump & Machinery Co. awarded contract for the meters as follows: [illegible] 1-2-in. meters, [illegible] 2-in. meters, 5 3-in. meters, at a total cost of $[illegible].

Mass., Worcester—Five orders for new water piping, to cost about $1,461 were approved by water committee.

Md., Baltimore—City is planning to expend $5,500,000 in water works improvements, the work to include raising Loch Raven concrete dam 240 ft. and increasing poundage of water to yield 146,000,000 gals. daily. William A. McGraw, city engineer.

Mich., Mt. Clemens, will vote Jan. 11 on $10,000 Water Supply bonds.

Minn., Sauk Center—City is planning issuing $60,000 bonds to improve water works system. L. P. Wolff, 100 Guardian Life Bldg., St. Paul., engineers.

Minn., Stephen—City election in the spring to vote on $30,000 bonds to build waterworks system. L. P. Wolff, 1001 Guardian Bldg, St. Paul, engr.

Minn., Ceylon—An election was recently held for the purpose of voting Water Works and Electric Light bonds to the amount of $15,000.

Miss., Union—An issue of Water bonds has been proposed. Amount not stated.

Miss., Sanatorium—State board of health recommends installing water supply system.

Miss., Macon—City voted $25,000 of water and light bonds. J. J. Scott, Clk.

N. C., Raleigh, will issue $50,000 Water bonds. J. B. Bray is Commissioner of Public Works.

N. C., Raleigh—An issue of Water bonds to the amount of $50,000 has been proposed.

N. C., Burlington—The sum of $25,000 will be expended for water works system. M. W. McPherson, clerk.

N. J., Arlington—It is stated that the new 48-in. steel water main from Arlington, which will augment the Bayonne N. J., water supply, will be completed about next March. The total cost is estimated to be about $2,000,000. The total length of pipe will be 44,000 feet when completed. About 25,000 feet have already been laid, and there is a force of some 400 men working on the contract.

N. J., Camden—Plans for increasing city's pure artesian water supply are being worked out.

N. Y., Binghamton—This city plans to issue bonds amounting to $21,000 for improvements on Prospect street by placing water mains.

N. Y., Ossining—C. F. Rattigan, supt. State Prisons, Capitol, Albany, received bids Dec. 8 building sewerage and water supply systems, here, from Carroll Contg. Co., 103 Park ave., New York, $313,392; A. F. Schaffer, 440 State St., Schenectady, $319,158; P. Keeler Bldg. Co., 425 Orange St., Albany, $337,480.

O., Niles—The officials of the town of Niles, Ohio, have resorted to stringent methods to remedy the wilful waste of water by certain of the consumers. It is said that the shortage of water in the city is growing decidedly grave and consumers have repeatedly been warned regarding the continued waste.

O., Lisbon—Board of Public Affairs is making a complete analysis of water supply, before planning the new water supply system, which would cost $100,000.

O., Salem—Survey for permanent water supply being made by Morris Knowles, Inc., of Pittsfield and Cleveland.

O., Warren—$875,000 bonds to be sold Dec. 27 for construction of filtration plant. Engr. Alexander Potter, 50 Church St., New York City.

O., Cuyahoga Falls—Village Clerk H. O. Bolich received sealed bids until Dec. 20 at noon, for 6 per cent. semi-annual, 26-year (average) Water Works Extension bonds to the amount of $55,000.

O., Warren—Necessary legislation looking towards the city taking over the operation of the water works is urged upon the city council by Mayor J. D. McBride.

Okla., Heavener—A proposition to issue the following bonds was submitted to the voters at an election on Dec. 6: Water Works System, $35,000; Electric Light System, $40,000.

Ont., London — Pub- Utilities Comn. plans to expend $135,000 for extensions to water distribution system; work involves c.i. pipe mains, hydrants, etc. E. V. Buchanan, Hydro Bldg., engr.

Ont., Toronto—The proposed expenditure of the Civic Works Department for a duplicate water works system off Scarboro will probably cost $16,000,000.

Ont., Shelburne—Town proposes to extend water works system, to include distributing system, centrifugal pumps, pump house and 10.000 feet 6-in. cast iron pipe. Estimated cost $100,000. E. A. James Co., 36 Toronto street. Toronto, engineers.

Ont., Ingersoll — Mayor Hendrickson recommends the extension of water service at an approximate cost of $10,000.

Ont., Sarnia—In January an election will be held to vote the issuance of Water Main bonds to the amount of $500,000.

Ore., Baker—A recent election resulted in favor of issuing Water System bonds to the amount of $7,500.

Ore., Portland—City offers for sale $200,000 Water bonds. Dec. 28, 1920.

Pa., Philadelphia—J. Joseph McHugh awarded contract for constructing 48-in. water main in 57th street, from Cedar avenue to Christian, and in other streets at $150,000.

Pa., Harrisburg — Council plans improvements to the city water works system entailing an expenditure of approximately three-quarters of a million dollars and including six new filter beds, a new sediment basin, with 4,000,000 capacity, a coagulant basin, new pumping engines and a new intake into the river.

Pa., Harrisburg—An ordinance for laying of water pipe in Greenwood St. has been passed.

S. D., Montrose—An election will be held in the near future to vote the issuance of Water Works and Sewer System bonds.

S. D., Montrose—Special election soon to vote bonds for install water system. Owner, city.

S. C., Seneca — City voted Dec. 15 on $160.000 bond issue for construction of water and sewer systems.

S. D., Flandreau—The new filtration plant just completed, will give, it is claimed, an ample supply of pure water.

Tenn., Knoxville—Improvement of water system will call for an expenditure of $1,500,000 according to Commissioner N. B. Kuhlman.

Tenn., Nashville—Improvements to water works are being considered.

Tex., Eastland—Bonds to the amount of $150.000 will be floated for water works improvements.

Tex., Big Spring—City proposes to increase its water supply and construct 1,500,000-gal. reservoir. The mayor.

Tex., Terrell—Work was recently commenced on the new reservoir to supply Terrell, Tex. It is expected that when completed there will be an ample water supply for the city.

Tex., San Benito—Work has begun on the new pumping station, the piling and walls are already in place, and it is expected that the plant will be completed in about two months at an expenditure of $150,000. The pump, which will have a capacity of 100,000 gallons, it is expected, will increase the output of the plant to about 43 per cent.

Tex., Amarilo—The Doherty interests, owning the City Light & Water Co., are planning to spend $75,000 on improvements this winter.

Tex., Austin—Attor. General's Department approved waterworks bonds of the city of Panhandle amounting to $12,000.

Tex., Dallas—Water and sewer service for Fitzhugh avenue district is proposed in a petition received by Water Commissioner Appel. Estimated cost of extensions, $7,000.

Tex., Port Arthur Water Improvement Dist. has voted $2,000,000 water bonds.

Va., Norfolk, has authorized $1,000,000 water supply bonds.

Wash., Seattle—Board of Public Wks. rejected all bids for steel pipe for the Newhalen Creek plant, 36-in.

Wash., Seattle—Construction work on the extension of city water system will begin soon. Board of Public Works will proceed with the construction of certain dams at Swan Lake, Council appropriated $5.000 for waterworks improvements.

Wash., Seattle—$3,000,000 for proposed extension of water system.

Wash., Kennewick—H. Day Hanford, consltg. engr. of Seattle, is here in consultation with the Highlands Water Users' Board regarding the installation of a pump for the domestic water system. He will also confer with J. J. Rudkin regarding the repainting of the Olmstead addition to Kennewick.

Wash., Kalama—An election was held Dec. 7 to vote the issuance of water bonds to the amount of $20,000.

Wash., Seattle—The construction work on the extension of the city water extension will be carried on without delay.

Wis., Viroqua—Council passed ordinance for $40,000 bonds for waterworks improvements. E. J. Older, city clerk.

Wis., Milwaukee—Dept. Public Works received bid Dec. 7 furnishing 2 circular sluice gates for Linwood avenue water tunnel, from Chapman Valve Mfg. Co., Indian Head, Mass., $5,040 each.

BRIDGES

Cal., Chico-Orland—Highway Comnr. has agreed to build a bridge. $250,000 appropriated for the purpose.

Cal., Williams—According to D. L. Rayburn, superintendent of the Grand Canyon National Park, the government will build a bridge across the Colorado River at Grand Canyon.

Cal., Los Angeles—Preparations will be made at once by Board of Harbor Commissioners for the building of a steel bascule or lift bridge across Long Beach channel, to connect Terminal Island with the mainland. Cost of bridge will be from $200,000 to $400,000.

Fla., Boynton—Town will receive bids until 7:30 p.m. Jan. 3 for $10,000 of 7 per cent semi-annual improvement bonds; $1,000 denomination. Geo. E. Coon, mayor.

Ga., Savannah—Survey is now being made for proposed bridge across Savannah river. State Highway Engineer W. R. Neel, Atlanta, Ga. B. H. Graff, division engineer, Savannah. (Preliminary plans now in hand.)

Ga., August—Richmond county commissioners will request Georgia Highway Dept., Walton Bldg., Atlanta, to proceed with construction of bridge over Savannah river at Sand Bar Ferry; South Carolina authorities are ready to cooperate. (This is Georgia-South Carolina Project No. 127).

Ia., Cedar Rapids—Ready for bids about Feb. 1 for approximately 3,000 sq. yds. pav. brk. blk., on 1st Ave. bridge. City engr., T. F. McCauly, City Hall. City Clerk. L. J. Storey, City Hall

Ia., Cedar Co. (P. O. Tipton)—An issue of Bridge bonds to the amount of $160,000 will be offered for sale in the near future.

Ind., Indianapolis — Board of Public Works plans the erection of a bridge over Fall Creek at Delaware street with driveways connecting the north end with Washington Blvd. and Delaware street. north of the creek.

Ind., Winchester The memorial committee appointed by the commissioners of Randolph County have prepared plans for a community memorial to be located in N. Meridan street. Estimated cost, $100,000.

Kan., Chapman—Dickinson Co. received bids building one 150 ft. span rein.-con. arch bridge near here, 18 ft. wide, involving 1,008 cu. yd. rein.-con. 40.8 tons steel, 4,080 lin.ft. wooden piling and 250 ft. cofferdam, from Koss Constr. Co., 2818 5th street, Des Moines, Ia.

Minn., Grand Rapids—Itasca Co. rejected bids received Dec. 7 building bridge 3252 over Mississippi river, to have four 60 ft. spans. About $100,000. Work will be readvertised.

Mont., Big Horn Co. (P. O. Hardin), has voted $100,000 bridge bonds.

N. C., Beaufort Co.—Board of County Commissioners offer $100,000 Bridge bonds, Jan. 3, 1921. Frank Kugler, Chn., Washington, N. C.

N. C., Washington—Comrs. Beaufort county will sell $100,000 bonds Jan. 13, to build bridges. C. P. Aycock, chmn.

Neb., Omaha—The city council deferred for one week action on a resolution offered by Mayor Smith, proposing to enter into a contract with Howard Hardington & Ash, Kansas City, for the preparation of designs, plans, drawings and general estimates on a proposed free bridge across the Missouri river between Omaha and Council Bluffs.

N. J., Trenton—The State Highway Commission announced that it had definitely decided upon the location of the new bridge over the Raritan River connecting Perth Amboy and South Amboy. Estimated cost of construction, $2,700,000.

N. J., Atlantic City—The Board of Chosen Freeholders has secured permission from the Board of Commerce for the Navigation of the State of New Jersey and from the War Department of the Federal Government to eliminate draw spans in the Beach Thorofare and in the Great Thorofare bridges on the Pleasantville Blvd. The county will proceed at once with extensive repairs to the two bridges.

N. J., Trenton—Location of the proposed new bridge connecting Perth Amboy and South Amboy was definitely settled by the State Highway Comm. A revised estimate required. The old estimate being $2,750,000.

N. Y., Binghamton—This city plans to rebuild the bridge that vaults the Hudson at an estimated cost of $1,000,000. J. F. O'Rourke, engineer.

N. Y., Groveland (P. O. Groveland Station R. D.), has voted $25,000 Bridge and Culvert bonds.

O., Akron—Detailed plans for the construction of 11 viaducts over, or tunnels under the railroad tracks between the Center and S. Main street crossings will start early in January.

Ore., Portland—County Commissioners contemplate paying $25,000 for rebuilding of the Burlington Bridge.

O., Youngstown—The General Improvement Committee of the City Council considers the construction of a high level bridge across Mill Creek Park, beginning at Warren avenue and extending to near Bear's Den road. Estimated cost, $200,000.

O., Youngstown—The city council has voted to issue $16.000 on bonds for the repair of the Cedar street span of the East Federal street bridge.

O., Cleveland—Law Director preparing to take legal action to compel the Pennsylvania R. R. to proceed with the elimination of Eastside crossings. City has agreed to advance $600,000 toward the work.

O., Belmont Co. (P. O. St. Clairsville) —County Auditor Arch T. Fogle will receive sealed bids until Dec. 27 at noon, for 6 per cent. M. & N. 4 1-6 year (average) Bridge coupon or registered bonds to the amount of $18,000.

O., Akron—Tentative plans for a concrete bridge of ornamental design to span the Ohio canal on the Kenmore Blvd. at an approximate cost of $240.000 have been prepared by the county engineer. The roadway will be 30 feet wide from curb to curb with sidewalks on both sides, each 10 ft. wide, and the structure will be 550 ft. long.

O., Dayton—The Conservancy Board will grant the request of the county commissioners that the raising and lengthening of Adams st. bridge at Troy be made part of the Miami conservancy project. Agreements between the commissioners and the Conservancy engineers have been reached.

Okla., Sequoyah Co. (P. O. Sallisaw)—An election will be held in the near future to vote the issuance of Bridge bonds to the amount of $200,000. These bonds were defeated at an election on Nov. 9.

Ont., Prairie Siding—Kent county retained W. G. McGeorge, engr., 151 Queen street, Chatham, to prepare plans for 380 ft. steel bridge, to have one 200 ft. stationary span and one 180 ft. swing span. About $150,000. Bids expect to be called early in January.

Ont., Arthur—The Municipality of Arthur will vote on $35,000 by-laws for reinforced concrete bridge.

Ore., Linn Co. (P. O. Marion), will offer $40,000 Road and Bridge bonds.

S. C., Columbia—State Highway Commission considers the construction of the Santee River bridge, also the Congaree and the Wateree River bridges.

S. C., Columbia—Richland county supervisors will erect bridge. S. H. Owens, supervisor.

S. D., Belvidere—Plans have been completed for a new bridge which is to be constructed across White river, south of Belvidere. If the bids are not satisfactory the commissioners of Jackson county will themselves put in the bridge, which will cost thousands of dollars.

Tenn., Knoxville—$500,000 is needed for viaducts and bridges to be constructed for this city, according to Commissioner N. B. Kuhlman.

Wash., Everett—County Engineer F. G. Tegtmeier was ordered by the County Board of Commissioners to make a survey for new overhead crossing over the Chicago, Milwaukee and St. Paul R. R. tracks from Cascade View avenue to the Summer Iron Works; also to make a survey and map of the location of the south end of the Snohomish River bridge at Snohomish. Temporary repairs will be made on the Glenwood Road No. 1 and No. 2.

Wash., Colfax—In an interview Senator Hall stated that growing sentiment for construction of state highway bridge would probably culminate in construction of 3 bridges by State during coming year. The proposed bridges receiving serious consideration are across Pond Oreile Oriver at Newpctt, across Columbia at Pasco, and across the Snake at Central Ferry.

Wash., Vancouver—Permit to construct toll bridge across Columbia at Cascades has been asked by Washington and Oregon corporation represented by Judge Miller at hearing before U. S. engr. at Portland.

Wis., Mauston—Juneau county board voted a county and state aid road construction program for 1921 of $12,825.60, surfacing of various roads. A. V. Robinson, New Lisbon, Wis., Comr.

Wis., La Crosse—La Crosse county soon receives bids building Smith Valley bridge, 24 ft. wide, concrete, to have two 45 ft. spans, on State highway 21, Campbell twp. About $17,000. J. Hintgen, comr., Wis. Hgwy. Com., Madison, engr.

Wis., Neilsville—City, Pine Valley twp. and Clark co. having plans prepared for 224 ft. rein.-con. bridge, 20 ft. roadway, with sidewalks, over Black river. Abt. $100,000. J. H. A. Brahtz, 409 Metropolitan Opera House Bldg., St. Paul, Minn., engr.

Wis., Prescott — Prescott Bridge Co. having plans prepared for 450 ft. steel bridge, 24 ft. wide, to replace ferry, over Wis., and Washington co., Minn. About $125,000. Toltz, King & Day, 1410 Pioneer Bldg., Ct.S Paul, Minn., engrs.

Wis., Wisconsin Rapids—City plans to build 500 ft. rein.-con bridge, 52 ft. wide, over Wisconsin river on Grand avenue. About $210,000. Wisconsin Hgwy. Comn., Madison, engrs.

LIGHTING AND POWER

Cal., Marysville—Electroliers be established at the intersection arches in the downtown section of the city.

Colo., Colorado Springs—According to Commr. of Public Works and Property the Colorado Springs Light, Heat and Power Company has agreed to changes and new installations of street light in said city, west of Monument Creek. Company is at work on the new program.

Eng., Knaresborough—Urban District Council is considering the possibility and cost of providing the town with electric light by using the water over the Weir for generating purposes, estimated to cost 3,700 pounds.

Ill., Moline—Water and Light Committee was authorized to order new st. lights installed on 13th avenue, road approaching the river road, near the harvester plant, and on 23rd avenue, between 7th and 8th streets.

Ind., Richmond—Immediate repairs are needed at the Municipal light plant. The drawing up of specifications for the foundation, wiring and piping for the new turbine will be undertaken soon.

Mass., Pittsfield—According to W. A. Whittlesey, manager of the Pittsfield plant, the company will spend $1,000,000 for the improvements within the next five years. Enlargement of the power station to cost $100,000.

Mass., Boston—Fred T. Ley & Co., Inc., 24 Milk street, Boston, were low bidders for installing an underground electric light service to Lion House, now under construction at Franklin Park, at $1,292.

Mich., Muir—The Gardner Lighting Co. of Muir, was given franchise for furnishing Pewamo witb electric light. The village will have 35 street lights.

Minn., St. Paul—Ramsey County Commissioners appropriated $2,000 for the construction and maintenance of electric lights on the White Bear road from Kellar pkwy. to Maple street.

Mo., Blairstown, is considering voting on Electric Light bonds.

Neb., Hickman, will shortly offer $2,000 Electric Light bonds.

N. J., Trenton—According to Commissioner Page it is planned to improve Trenton's lighting system at a cost of $25,000. Plan includes the installation of large arc lamps at all street intersections and the smaller lamps placed along tne streets between intersections.

N. Y., Boro Brooklyn—The Public Service Commission issued a final order authorizing the Kings County Lighting Company to issue $2,000,000 8 per cent cumulative preferred capital stock.

N. Y., New York City—The Croker National Fire Prevention Engineering Co., 22 W. 30th St., New York City, were low bidders for furnishing, delivering and installing conduits, cables, wiring, protector frame and appurtenances in the Manhattan Central Office.

O., Salem—The A power house and 12 miles of transmission line (66,000 volts) will be constructed for the Salem Lighting Co. Day & Zimmerman, architects, Philadelphia, Pa.

Okla., Nash, is contemplating voting on $15,000 Electric Light System bonds.

Okla., Guymon — An election was held Dec. 21 to vote the issuance of Light and Power Plant bonds to the amt. of $35,000.

Ont., Hamilton—It has been proposed to issue $5,762,990 Civic Gas Plant bonds.

Pa., Sharon—The United National Gas Co. will extend gas mains to Brookfield twp. About 2 miles of pipe will be laid.

Tex., Houston—The Southwestern Telegraph and Telephone Co. will submit improvement plans to the city soon. E. C. Pike, district engr.

Tex., Ranger—The Retail Merchants Assn. will provide funds for 15 blocks of white way in this city. It is estimated that the system can be installed for $2.50 a front foot.

Wash., Seattle — Federal Telegraph Co. will construct four wireless stations, one at Palo Alto, one near Portland, Ore., one near San Diego and one near Los Angeles. Project will involve $500,000.

Wash., Salem—According to Attorney Harzog of the Great Northern R. A. a huge power plant will be erected at the foot of Lake Chelan.

Wash., Seattle—Board of Public Works approved the plan of City Supt. of Lighting J. D. Ross to equip four of the 14 boilers at the Lake Union Steam Plant with stokers at a cost of $150,000.

Wash., Seattle—It was decided at the finance committee meeting to offer $1,005,000 worth of Municipal Light Extension bonds for sale, so that the proceeds may be used to continue work at the Cedar River project, the Lake Union steam plant and for other extension work.

Wis., Stevens Point—City council postponed orn. st. light. sys. until 1921. Charles [illegible], chm. comm. of council.

Wis., Oshkosh—Ready for bids soon for orn. st. lgt. sys. Cons. engr., William A. Baehr, 1013 Peoples Gas Light and Coke Co., 122 S. Michigan ave., Chicago, engr.; [illegible] William F. Porath, chm. Bd. of Pub. Wks., $75,000.

FIRE

Ariz., Phoenix—A recent election approved of bonds for purchase of fire apparatus and building fire station, $65,000.

Ark., Little Rock—Fire department will purchase a $12,000 triple combination fire apparatus for Engine House No. 1 in the early part of 1921.

Canada, East Kildonan, Man.—An issue of $15,000 Fire Hall bonds was voted on at an election held on Dec. 4th.

Ill., Albany—Meeting is to be held soon for the purpose of organizing a fire department company.

Ill., Belleville—By the acquisition of a new ladder truck the fire department of Bellevile, Ill., becomes entirely motorized. The city now has, besides the ladder truck, two motor hose cars and a chief's run-about with light fire-fighting equipment.

Ind., Indianapolis—City has authorized $400,000 Motor Fire Equipment bonds.

Iowa, Des Moines—Kelsey L. Walling of the Iowa Ins. Service Bureau, has published an eight-page illustrated report on the Manhattan Oil Plant fire, and consents to furnish members especially interested who will write him for a copy. Des Moines, Iowa.

Mass., Langmeadow—Fire department was recently organized.

Mo., Sikeston—A recent election resulted in favor of issuing Fire Equipment bonds to the amount of $25,000.

Mont., Ryegate—A fire department was recently organized in the city of Ryegate, Mont., and apparatus has been purchased for the members' use. Ryegate is now the county seat, and with the addition of an adequate water supply and fire-fighting apparatus it is expected tht the city will grow in size and importance.

N. J., Gloucester Heights—The cornerstone of a new fire house for Gloucester Heights, N. J., was laid with a street parade and other ceremonies. The fire company was organized this year. The building is to be 24x36 ft. and constructed of concrete. The work is to be done by the members during their leisure time.

N. J., South Amboy—Protection Engine Company is now without apparatus, their only piece, an old-fashioned steamer, having become unserviceable.

N.J., East Newark—The firefighters of this borough are urging the mayor and council to purchase modern fire apparatus to supplant the present antiquated wagons.

Ky., Frankfort—Construction of storm water and sanitasy sewers contemplated.

N. Y., Leicester—Town is without any adequate fire-fighting apparatus.

N. Y., Mount Vernon—Organization of fire company is contemplated.

N. Y., Livingston Manor—Election will soon be held to vote on proposition to raise money by taxes for the purpose of furnishing fire protection.

N. Y., Union—New fire alarm system has been voted by board.

N. Y., Hamburg—Town needs new fire apparatus.

O., Massillon—Members of the city council and city officials have determined that station No. 3, located in State St., needs a new fire truck after a demonstration of the one now in use at that station. The department has asked the council to purchase a new motor truck for that station. R. H. Hickok is safety director.

O., Ravenna—At the December meeting of the city council the city purchased a fire pump at a cost of $12,850 delivery to be made in 90 days.

O., Cleveland—City board of control authorized the expenditure of $[illegible] for five 750-gallon motor driven combination hose and pumping engines, three new motor hose cars for stock, [illegible] feet of fire hose, and 18,197 feet of underground lead cable for fire alarm purposes.

O., Akron—The fire department will receive its first expansion since 1908 when the new No. 9 station opens on Dodge avenue soon after the first of the year, according to Fire Chief Mertz. Fire Chief Mertz states that to give the city adequate protection at least five additional stations are needed.

O., Kenton—An inspector from the bureau of inspection of the State Fire Marshall's office will be here to inspect the fire department and see a demonstration of the new motor fire truck so as to determine if lower rates can be established for insurance. Two motor trucks were purchased some time ago but there has been considerable discussion concerning the purchase.

O., Youngstown—The council at the last meeting transferred from the municipal fund $4,000 for the purchase of additional fire hose for the department. This resolution was passed under suspension of the rules as there has been a delay in the purchase of the fire hose appropriation which was made some time ago.

Ore., Portland—$128,000 Fire Department construction bonds authorized. $150,000 Fire Dept. bonds also.

Ore., North Powder—An election held Nov. 10 resulted in favor of issuing Water and Fire Protection bonds to the amount of $7,500.

Pa., Harrisburg—City Council has appropriated $9,000 to pay for repairs to fire apparatus and fire houses.

Pa., Reynoldsville — The question of motorization and motor pumpers will be considered at a meeting to be held Dec. 7.

Pa., Mercer—East End Hose Company has raised over $2,000 for the purchase of fire truck.

Pa., Belle Vernon—Volunteer firemen are endeavoring to raise the sum of $10,000 for a modern motor fire truck.

Pa., Middletown — Liberty Fire Co. is raising money for a combination pumper.

Pa., Swedeland—The Volunteer Fire Company No. 1 was organized recently.

Pa., Edwardsville—Council has decided to purchase 300 feet of rope for fire department.

Tenn., Memphis—Plans to install the two-platoon system in the fire department on January 1, 1921.

Tex., Hallettsville—A new piece of motor apparatus has just been received by the fire department of the ctiy of Hallettsville, Texas.

Utah, Tooele—Voted on Nov. 2 on $15,000 Fire Department bonds.

Wis., Menomonie—Has authorized $12,500 Fire Equipment bonds.

W. Va., Warwood—Entire village was threatened by recent fire owing to low pressure of water and lack of pumper.

MISCELLANEOUS

Ala., Lanett—Lanett Cotton Mills and Langdale Cotton Mills are having considerable park and planting work done under the supervision and direction of E. S. Draper, landscape architect, Charlotte, N. C.

Cal., Stockton—A special election will be held on Jan. 11 for the purpose of issuing bonds amounting to $1,500,000 for the realization of the Calaveras flood control project. A. C. Oullahan, mayor.

Del., Wilmington—Work on the modern port terminal at the Lobdell tract will be started by the Board of Harbor Commissioners early in the spring. The project will involve an expenditure of $1,600,000.

Fla., Jacksonville—City is considering issuing $1,000,000 of terminal and $175,000 of drainage bonds. J. S. Bond, chairman city commissioners.

Fla., Jacksonville—Will vote on $1,[illegible] dock bonds.

Ga., Carnesville — Franklin county drainage district has issued $25,000 of 6 per cent semi-annual $1000 demonination drainage bonds.

Ga., Lafayette—W. A. Enlo, manager Consolidated Textile Corporation, has retained E. S. Draper, landscape architect, Charlotte, N. C., to plan development of grounds of his new residence.

Ia., Vinton—Election soon to vote $45,000 bonds for water and electric improvements. N. A. Klingaman, city clk.

Ia., Rockwell City—Drainage—Bd. Supervisors Calhoun Co., rejected bids received No. 10 building D. D. 45. R. B. Dixon, aud.

Ida., Caldwell—Canal. Power Irrigation dist. election Dec. 20 voted on $215,000 bonds to line several miles of side hill canal, with concrete, also build cement head gates and purchase drag line dredge. F. L. Evans, secy.

Ida., Big Lost River Irra. Dist.—(P. O. Mackay) has voted $20,000 Irrigation bonds.

Ill., Kankakee—Is contemplating issuing $150,000 public improvement bonds.

Ind., Indianapolis—Plans are being perfected to complete the flood prevention work started in 1916. Plans call for retaining walls on the east bank of the river from the bridge of Kingan & Co. south to Morris street, and improvements and additions to the intervening bridges. The flood extension work will cost nearly $2,000,000. Frank C. Lingenfelter, City Civil Engineer.

Mich., Detroit—Hazard Mfg. Co. low bidder for furnishing the Police Dept. with 18,000 ft. of four conductor, lead encased parkway cable at $203 per thousand feet. Schmied Coal & Lumber Co., of Detroit, low bidder for furnishing Board of Water Comrs. with rough fir.

Mich., Battle Creek—Voted $90,000 athletic park bonds.

Miss., Batesville—Ditches: Sub. Dist. No. 1, Indian Creek D. D., Panola Co. had plans prepared by Morgan Eng. Co., engrs., Goodwyn Institute, Memphis, Tenn., building 6 miles open ditches to reclaim 3,200 acres. Work involves 82,500 excav. About $30,000.

N. C., Swan Quarter—Dredging—Hyde Co. D. D. 2 plans to issue $393,000 bonds, half of which is to pay for work already done and balance for new light dredge work. J. A. Leigh, chn.

N. Y., Boro Bronx—Committee of Finance approves of issuing special revenue bonds, $14,710, for purchase and erection of tree guards on Grand blvd. and Concourse. Com. of Parks, Bronx.

N. Y., New York—City adopts resolution providing for $65,000 issue, for dredging slips adjacent to piers in East and North Rivers.

O., Canton—City engineers planning a system of boulevards along West Creek.

O., Canton—Bids on $365,000 in bonds are being taken to Jan. 3, the proceeds to be devoted to straightening and dredging the Nimishillen creek here. The city engineer is W. E. Saur.

O., Toledo—An ordinance was passed providing for the issuing of bonds for park purposes to the amount of $14,000.

O., Zanesville—Council passed ordinance for the issuance of bonds of $200,000 for the purpose of acquiring and improving park lands and playgrounds in this city by the board of park comrs.

Okla., Oklahoma City—An appropriation of $55,000 for the purpose of making repairs on the reservoir dam and strengthen the east bank just below the by-pass spillway was recently passed by the city commissioners of Oklahoma City, Okla. Twenty thousand dollars will be spent in raising the embankment adjoining the diverson dam, whch was severely threatened during the last flood. Twenty thousand dollars more is required to raise the rip-rap on the embankment west of the main dam. And $15,000 will be used in protecting the conduit from being undermined by strengthening the east bank just below the by-pass spillway.

Okla., Fairview—An election was held Dec. 7 to vote the issuance of park bonds to the amount of $15,000.

Ont., Toronto — The Toronto Harbor Commission now have plans ready for extending the harbor improvements from Woodbine avenue to the eastern city limits.

Ont., Ottawa—Conveyance of the oil products of the Mackenzie River basin to Behring Sea by pipe line is a project for which sanction will be sought by a bill to be considered by parliament at the approaching session. The proposed pipe line would be laid from the Mackenzie River to the Yukon River systems.

Ont., St. Thomas—A by-law providing for the issuance of $233,000 debentures for the erection of a concrete, earth and slip dam across Kettle Creek, and for improvements to the water works department, will be submitted to ratepayers Jan. 3. City clerk, W. B. Doherty.

Ont., Mimico—A proposition to issue park bonds to the amount of $14 000, will be submitted to the voters at an election on Jan. 1.

Ore., Enterprise — Northern Pacific Construction Co., wants prices and descriptions of: Rooter plows, road drags, road graders, two-wheel scrapers, four-wheel scrapers, dump wagons, dump cars, motor trucks, steam shovels, stone crushers, screening plants, stone unloaders, stone spreaders, air drills, road levelers, subgade machines, gasoline rollers, steam rollers, scarifiers, concrete mixers, small, forms for curbs and gutters, sidewalk forms, culvert forms, reinforcement fabric for concrete pavements, concrete pavements, concrete tampers, loaders for concrete mixers, batch boxes, reinforcement bars, tunnel forms, wheelbarrows, shovels, picks, concrete carts, steam drills, stone and sand screens, stone and sand elevators, sand elevators, sand washers, black powder, dynamite, fuses, asphalt street tools, asphalt plants, portable, trucks, trailers, tractors, diaphragm pumpm, backfiller machines, manila rope, concrete hoisting towers, wire rope, water tanks, portable field office buildings, picks and shovels, trench excavating machines, air compressors, portable, concrete chutes.

Porto Rico, Arecibo—Sealed proposals will be received by Jose Adorno, Municipal Secretary, until Jan. 31, 9 a.m., for the purchase of $592,000 5 1-2 per cent. 12 1-2 yr. av. Municipal bonds.

Tex., Galveston Co. (P. O. Galveston), will offer $220,000 Causeway Warrants.

Tex., Freeport, has voted $133,000 6 per cent. 2-19 yr. sr. Levee bonds which will be offered about January 1st.

Tex., Ballinger—Representatives from 20 towns in Runnels, Coke, Tom Green and River counties will organize a Colorado River Irrigation Association and formulate plans leading to the erection of a huge dam across the Colorado in Coke county. Survey of project was prepared by Captain Stanley of Dallas.

Tex., Cleburne — County Engineer Whiteaker is working out drainage plans for the building of West Buffalo Creek.

Wash., Seattle—Citizens will vote in March on a bond issue not exceeding $400,000 for the purchase of a site for additional playfields.

Contracts Awarded

STREETS AND ROADS

***Ala., Birmingham**—A contract was awarded to the [illegible] Construction Co. for $[illegible] for the paving of Eighth Ave., South, between [illegible] Sts. and [illegible] Sts. H. N. [illegible] was awarded a contract for the paving of 78th St. from 11th to 12th Aves. North for $[illegible].

***Ariz., Tucson**—Contract awarded to the West Coast Construction Co., of Tucson, for 17,195 sq. yds. of Warrenite Bitulithic pavement on 4 in. concrete foundation.

***Cal., Modesto**—Contract awarded to Standard Paving Co. for [illegible] sq. yds. of Warrenite-Bitulithic on 4 in. concrete foundation.

***Cal., Los Angeles**—City let contract paving Cudahy ave., involving 560 cu. yd. excav., 4,316 ft. shaping roadbeds and 10,625 sq. ft. 4 in. Willite pavement, to Lagana Land Co., Consolidated Realty Bldg.

***Cal., Los Angeles**—Janss Investment Co., Metropolitan Bldg., will grade and oil streets, construct cement curbs and sidewalks, lay gas, water and sewer mains in their 60 acre subdivided tract on Lus Feliz road and Vermont avenue. Cost to exceed $10,000. Work will be done by day labor under supervision of W. H. Tuck, engr.

***Cal., Los Angeles**—William L. Riley awarded contract for the construction of improvement on 52d street as follows: Rough grading to grade at 6 cents per sq .ft. finishing grade, oiling and rolling at 7 cents per sq. ft., cement sidewalks, 23 cents a sq. foot, cement curb, 70 cents per lineal ft., concrete gutter, 33 cents per sq. ft.

***Cal., Los Angeles**—Clyde S. Yerge awarded contract for improving streets at 23c per sq. ft. for rough grading, 7c per sq. ft. for finishing grade, oiling and rolling, 75c per lin. ft., for cement curb, 25c per sq. ft. for cement sidewalks, 35c per sq. ft. for concrete gutter.

***Cal., Los Angeles**—Roger Bros. award contract for paving Lark, Ellen and Merced streets, southwest of Covina, at $57,000. The distance to be paved, 2 1-2 mi.

***Fla., Tampa**—Board of Public Works lets contract for Ashley street improvement to Holwell & Owens Co.

***Ia., Marshalltown**—The Wright Construction Co. of Des Moines, awarded contract for six miles of concrete paving on highways of Marshall County, at $2.17 a sq. yd.

***Ill., Quincy**—Frank Rees, Quincy, Ill., awarded contract for the following improvements of 8th street: 4,200 sq. yds. of Portland cement concrete pavement; 3,100 linear feet of Portland cement concrete curbing, integral with the pavement, 970 lineal feet prepared fibre matrix and bitumen expansion joint filler. 1,800 cu. yds. excavation grading and preparing subgrade. Total cost $19,739.

***Ind., Owen Co.**—The commissioners have let the contract for the E. W. Rucker road to M. K. Hanna of Bloomington, Ind., at $6,295.65.

***Ind., Pulaski Co.**—The contract for the Dillard Berryman road was let to John Featherstone of Winamar at $15,989.

***Ind., Shelbyville**—Richards and Lawson Co., Shelbyvile, awarded contract for furnishing signs to be placed at all street corners at 3 cents a letter.

***Kans., Kansas City**—H. A. Hepler, 700 W. 12th St., in market for 10-ton 3-wheel road roller.

***Ky., Covington**—Comm. Pub. Wks. let contracts building 6-18 in. sewers in 27th St. and Decoursey Ave., to E. J. McKenna, Covington, $22,868 and $7,276 respectively; Madison Ave., to W. Metzel, Covington, $6,834.

***Mass., Chelsea**—Contract awarded to Warren Bros. Co., of Boston, Mass., for [illegible] sq. yards of Warrenite-Bitulithic resurfacing.

***Mass., Northampton**—City let contract building 1 story brick and concr. pumping station, [illegible] ft. 16 in. c.i. pipe line and [illegible] ft. 10 in. c.i. pipe line with manholes, covers, etc., to D. A. Sullivan, Paradise Rd. About $15,000.

***Mich., River Rouge**—Village let contract building rein. con. sump for sewerage system, involving 1,450 cu. yd. excav., 280 cu. yd. rein.-con. and 10 1-2 tons steel, to Boston & Errington Cement Constr. Co., 108 Buhl Blk., Detroit. About $20,000. Noted Dec. 2.

***Mich., Hamtramck** (Detroit P. O.)—Village let contract furnishing and laying 3,870 ft. 6 in. c.i. watermains, etc., to J. A. McPhee, 4036 Fairview Ave., Detroit. About $15,000.

***Mich., Detroit**—City let contract building Six Mile Rd. Sewer, Sect. 5, from Lumkin to Omira Aves., and Sec. 6, Omira to Third Aves., to J. Porath, 2[illegible] McGraw Bldg., $418,000 and $354,114 respectively; Sect. 7 from Third to Linwood Aves., to W. Blanck & Co., 827 Ford Bldg., $239,117.

***Mont., Butte**—A. Carlson, of Columbus, awarded contract by state highway commission, project No. 134, three miles of gravel road in Sweetgrass County, at $35,000.

***N. C., Charlotte**—The Elgin Motor Sweeper Co. was awarded contract for a motor driven street sweeper, at $7,350.

***N. C., Maiden**—Town let contract building 4 mi. water mains, one 100,000 gal. standpipe, deep wells, pump houses, etc., and 3 sewerage disposal plants, to Higgins & Goforth, Charlotte. About $100,000.

***Nev., Carson City**—John Ross, Yerington, awarded contract for concrete culverts and gravel surface for a portion of the state highway system in Douglas county from a point 1.81 miles north of Minden to a point .45 miles north of Minden. Work to cost $7,989.

***Neb., Omaha**—Moberly Brick Co., of Moberly, Mo., awarded contract by Chas. E. Fanning for furnishing brick at $1.37 a sq. yd. for the paving of Leavenworth st., from 48th to 60th sts. The stretch of paving involves 18,000 sq. yds.

***N. J., Trenton** — John H. Hurley awarded contract for building the concrete retaining wall on the approach to Miry Run Bridge on the back road between Hamilton Square and Windsor, at $6,195.

***N. Y., Dundee**—The contract for the construction of the state road between Dundee and Wayne has been let to the Lane Construction Co.

***O., East Cleveland**—City let contract building sewer and culvert to Terrace Rd. between Taylor Rd. and Hastings Ave., to T. Marro, Illuminating Bldg. Cleveland, $16,501.

***O., Cincinnati**—Contract for the improvement of the Glendale and Milford road have been awarded to the Gradison Construction Co., on a bid of $153,941.80.

***Okla., Oklahoma City**—City let contract paving 1st street from Western to Francis avenues and Francis avenue from Main to 2nd streets, 1 1-2 in. sheet asphalt on 1 in. binding course on 6 in. concrete base, to Western Paving Co., 518-19 Terminal Bldg., $25,959.

***R. I., Providence**—Contract for Federal Aid Project awarded to Powers Brothers, of Brockton, on their bid of $40,000.

***Tex., El Paso**—Contract awarded to El Paso Bitulithic Co., of El Paso, Tex., for 21,307 sq. yds. of 1 1-2 in. Warrenite-Bitulithic pavement on 5 in. concrete foundation.

***Tex., Tillsboro** — Brown & Root of Taylor, Tex., awarded contract for grading, surfacing with gravel and construction of drainage structures upon the Irene-Mertens and the Irene-Corsicana roads in the Irene Special Road District No. [illegible], for total of $[illegible].

***Tex., Dallas**—County commrs. of Lamb Co. let contract for road construction of [illegible] miles of highway, $[illegible].

***Utah, Salt Lake City**—City let cont. paving 1,400 ft. [illegible] st. from Fire station to 13th st. [illegible] ft. wide, 7 in. plain concrete, to Campbell Bldg. Co., Newhouse Bldg., $[illegible].

***Va., Richmond**—Dept. of Public Wks. awarded contracts for street work to C. S. Luck for $[illegible] grading Virginia St., [illegible] and [illegible] for $[illegible]; gravel Union St., W. L. Carter, Granolithic curbing and guttering, $3,842. F. J. McGuire for $[illegible], [illegible] paving Linden St. Paving Morris St. to T. J. McGuire, $[illegible].

SEWERAGE—SANITATION

***Cal., Calexico**—City let contract constructing 10,417 ft. 6 in. vitr. sewers, etc., to H. H. Peterson, Calexico, $16,837.

***Fla., Key West**—City council approves of contract with the Ulen Contracting Corp., of New York, to make a preliminary survey, plans and estimate of cost of a complete sewer system.

***Iowa, Bellevue** — The city council awarded contract to Hammen - Kraus Construction Co., Spencer, Ia., $67,305 for new sanitary sewer.

***Ind., Indianapolis** — Contracts were awarded as follows: Local sewer in Buckingham Dr., Columbia Constr. Co., at $3,176; local sewer in Belmont ave., to Sheehan Constr. Co., $13,392.

***Mich., River Rouge** — The Boston-Earring Cement Construction Co., of Detroit, were awarded contract for sewer sump for the village of River Rouge, at $3,625. Reinforced concrete sump 40 feet long by 21 ft. wide, 26 feet deep.

***N. J., Roselle**—Carmine Guerriero, of Garwood awarded contract for the construction of a sewer in Stockton ave., at $1,408.

***N. J., Paterson**—Hoad & Decker, Ann Arbor, Mich., has the contract for the new water works system.

***O., Akron**—Crano, Darrow & Lombarchi, Akron, O., awarded contract for construction of sewer in Margan street, 8-in. diameter, at $2,624.

***O., East Cleveland**—A. Marra of the Illuminating Bldg. has the contract for a sewer and culvert. M. V. Garrett, East Cleveland, engineer.

***Tex., Eastland** — Janes Contracting Co., awarded contract for sanitary sewers 6 in. to 12 in. and storm sewers 36 in. to 60 in. appr. $185,000. J. A. Wright, city engr. W. Lander ,city manager.

***Tex., Fort Worth**—The contract for the construction of two storm sewers on Evans avenue was let to the Wills & Tyson Constr. Co., $5,000.

***Tex.**— E. K. High was awarded contract for sewer on La Branch st.

***Utah, Salt Lake City**—City let contract building sewers in 5th street south to Los Angeles & Salt Lake R. R. tracks, and in 8th street west to Redwood road, involving 28,367 ft. 8-21 in. vitr. and 530 ft. 24 in. c.i. pipe, to R. L. Campbell, Salt Lake City, $200,168.

WATER SUPPLY

***Mich., Saginaw** — Contract for construction of steel pipe lines and river crossing at Holland ave,. awarded to Gillespie Contracting Co.

***O., Akron**—Drave-Doryle Pump Co., awarded contract for furnishing motor driven centrifugal pumps at $3,200.

O., Cleveland - Matheson Alkali Works, 25 W. 43d street, New York City, awarded contract for supplying liquidified chlorine gas for Division of Water, at 8c per pound, or a total of $4,800.

***Pa., Philadelphia** Municipal contracts approved by Mayor Moore were: Eastern Machinery and Equipment Co., $7,500 for furnishing sluice gates for Queen lane filters; Dunlap Printing Co., $3,150, furnishing indexes, printed blanks and forms, bureau of water; McAvoy Vitrified Brick Co., $3,000, furnishing brick for Lardner's Point and Torresdale pumping station; W. P. Mackenzie Co., $2,100, furnishing generator set for Wentz farm pumping station, and Albert Andelman, $1,100, furnishing printed forms etc., bureau of water.

BRIDGES

***Ia., Manchester** — Delaware Co. let contract building rein-con. deck ribbed arch bridge, to have two 87 ft. spans, 26 ft. roadway and two 5 ft. sidewalks, to Miller-Fifield Constr. Co., L. & J. Bank Bldg., Waterloo, $43,988.

***La., New Orleans**—Railway Commission building gulf coast bridges. Contracts awarded to the American Bridge Co. Estimated costs are $1,334,000 and $3,422,000.

***Mich., Lansing**—Murray & Fremont, Bad Axe., Mich., awarded contract for constructing bridge No. 321501 in Huron county, McKinley Twp., crossing Pigeon River, at $14,000.

***Minn., Grand Rapids**—E. W. Coons Co. of Hibbing, awarded contract for building a stone, steel and concrete bridge across Pokegama Lake, at $191,779.

***O., Dayton**—Bridge to cost $225,000 to be erected. Contracts for the substructure of this bridge awarded to Yander Co., Indianapolis, Ind. Superstructure awarded Dec. 18.

***Okla., Lawton**—Comanche Co. let contract building bridges and culverts, to Boardman & Co., Oklahoma City. About $39,000.

***Wyo., Cheyenne**—R. M. Templeton of Thermopolis awarded contract for construction of a reinforced concrete bridge across the Big Horn River at Thermopolis. Estimated cost, $70,000.

LIGHTING AND POWER

***Ind., Indianapolis**—Contract awarded to J. D. Lyon, by Board of Public Wks., to take charge of all improvements and repairs at the city's electric light and repair plant.

received a contract for construction plant, principally boilers, in connection with the Queenston development.

FIRE

***Ind., Indianapolis**—A bond issue of $400,000 to cover the cost of the motorization of the Indianapolis fire department, was sold by the civil city to the Meyer-Kiser Company, on a bid of par with interest at 5 1-4 per cent. The only other bidder was the Indiana Trust Company, which offered to buy $100,000 of the bond issue, maturing in 1937, 1938, 1939, 1940 and 1941, at par and bearing 5 1-4 per cent interest. The bonds will mature at the rate of $20,000 annually, beginning January 1, 1922.

***Ind., Fort Wayne** — The Gamewell Telegraph Alarm Company of Newton Upper Falls, Mass., will be awarded contract for installing a new fire alarm system in the city at $23,947.

***O., Cleveland**—The White Co., Cleveland, O., awarded contract for furnishing and delivering one 3 1-2 ton truck for the division of fire, Dept. of Public Safety, at $5,240. The Seagrave Co., of Columbus, O., for furnishing and delivering fire 750-gal. motor driven combination hose wagons and pumping engines for the division of fire, Dept. of Pubilc Safety, at $56,557. The Robinson Fire Apparatus Mfg. Co., St. Louis, Mo., for furnishing and delivering three automobile hose wagons for the division of fire, Dept. of Public Safety, at $23,109. The Safety Insulated Wire & Cable Co., Chicago, Ill., for furnishing and delivering approximately 48,197 ft. underground lead cable for the division of fire alarm system, Dept. of Legislature, at $20,053

MISCELLANEOUS

***Ala., Mobile**—J. A. Gilbert of Mobile awarded contract for driving test piles and setting up borings on the Island of Blakely on the east side of Mobile River. Test piles $8 per foot each driven foot. Wash borings, $4.25 each set.

***Cal., Redding**—The Happy Valley Irrigation Dist. has been authorized to call an election to vote $150,000 more of bonds for completion of the system. The entire system involves an expenditure of $765,000.

***Md., Baltimore**—The Bethlehem Shipbuilding Corporation awarded contract for the repairs to the "Collera," at $9,200. Bredden Shipbuilding Co. for repairs to "Tolosa," at $2,075. The Baltimore Dry Docks Shipbuilding Co. for Goree, at $608 and the Independent bridge at $1,326.

***New Jersey**—Bids were opened on October 20, 1920, for the building of a dam and other work in connection with the Wanaque Dam of the North Jersey District Water Supply Commission. The work consists of building an impounding reservoir of 11,000,000 gallons capacity on the Wanaque River, and an earth dam about 1000 feet in length. Work on this project will require 85,000 cubic yards of excavation, about 16,000 cubic yards rock excavation, and there will also be about 29,000 yards of concrete to be placed. Mr. W. H. Gahagan of Brooklyn, N. Y., has been awarded this contract. We are informed that he was not the lowest bidder but he received the job because he had ready to put on the job first-class equipment and organization.

***N. J., Elizabeth**—The mosquito extermination work in Union County in 1921 will cost approximately $35,000, according to the Board of Freeholders.

***O., Sandusky**—The contract for dredging the harbor has been awarded to the Central Dredging Co., 621 Bangor Bldg., Cleveland. Engineer Capt. W. E. R. Covell, 420 Government Bldg., Cleveland.

***Pa., First Stroudsburgh** — Borough council awards contract for reservoirs and dam to the Stewart Construction Co., of Easton, $40,209.

***Rio Janerio** — Pearson Engineering Corporation of New York City awarded contract for construction of port, sanitation facilities and paving streets in Nictheron.

S. C., Charleston — Jefferson Construction Co. received contract from H. F. Barkerding to build 177-ft. wharf and slip; later to erect additional building.

***Tex., Dallas**—W. A. Keene of Kansas City was awarded the contract by the City Council for the completion of the Lake Penick dam, which is being built by the municipality at a cost of around $500,000. The former contract on this dam was held by List & Gifford of Kansas City, but was forfeited recently and new bids asked for.

***Va., Richmond**—Board of Public Wks. approved the following award made by Director Trafford, of the Public Utilities Dept. To Jeffrey Manufacturing Co. for two coke elevators, amounting to $6,325. To U. G. I. Construction Co. for furnishing and erecting parts for hydraulic operation and automatic control for the water gas set, amounting to $10,250.

***Wash., Seattle**—Colussio & Erickson low bidders for building two earth dams at Swin Lake, at $54,054; for hydraulic fill, at $54,954. Hurley, Mason & Co., low bidders for Firlands Tunnel, at $5,750. MacRae Bros., low bidders for general contract at $157,486.

***Wash., Aberdeen** — Approved of contracts for a two-year-old lease of the electric dredge Wash No. 4, from the Tacoma Dredging Co., at a cost of $2,500 per month.

***Wash., Seattle**—The contract for the construction of dams at Swan Lake was awarded to Coluccio & Erickson, 425 Railway Exchange Bldg., on successful bids of $54,954 40 for the rolled embankment contract, or $54,954.40 for the hydraulic fill, by the Board of Public Wks.

TOO LATE FOR CLASSIFICATION

BIDS ASKED FOR

STREETS AND ROADS

Ind., Princeton. 11 a.m., Dec. 29
For the constr. of a stone and gravel road in Mont. twp.—J. H. Armstrong, aud.

Ind., Princeton. 11 a.m., an. 4
Constr. of a gravel road in Barton twp.—J. H. Armstrong, aud.

Ind., Princeton. 11 a.m., Jan. 4
Building a road in Columbia twp.—J. H. Armstrong, aud.

Ind., Princeton. 11 a.m., Jan. 4
Bor building stone and gravel road in Center twp.—J. H. Armstrong, aud.

Ind., Rensselaer. 2 p.m., Jan. 3
Constr. of a highway improvement in Milroy twp.—S. C. Robinson, aud.

Ind., Rockville. 1 p.m., Jan. 4
Gravel road in Washington twp.—Ralph E. Porter, aud.

Minn., Austin. 2 p.m., Jan. 5
For the graveling of Fed Aid Project No. 38.—O. J. Simmons, co. aud.

Minn., St. Paul. 10:30 a.m., Dec. 27
For improvement of Hersey ave.; also Hamline ave.; and on Alaska ave.—H. W. Austin, city purch. agt.

Minn., St. Paul. 10 a.m., Jan. 3
For grading and curbing in culverts on St. Paul and Duluth hgwy.—George Ries, courthouse, co. aud.

SEWERAGE

Minn., Duluth. 11 a.m., Dec. 27
For constr. a sanitary sewer.—F. D. Ash, clerk.

LIGHTING AND POWER

Wis., Camp Douglas. 4:30 p.m., Dec. 27
For furnishing a heating system.—Henry C. Engels, 425 E. Water st., Milwaukee, Wis.

BRIDGES

Wash., Newport. 2 p.m., Dec. 30
For the constr. of a pile bridge across slough on Dalkena Ferry road.—S. M. McGree, clerk of the Bd. of Co. Comrs.

MISCELLANEOUS

Ia., Rockwell City. 10 a.m., Jan. 5
For joint drainage dist. 181.—R. B. Dixon, co. aud.

WORK CONTEMPLATED

STREETS AND ROADS

Alta., Vauxhall—There are strong possibilities that the highway between Medicine Hat and Vauxhall will be graded in the near future.

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Any one of these reasons is enough to cause you to investigate Tiffin 2-Motor-System Street Flushers. Together these reasons furnish indisputable proof of the greater worth of Tiffin Flushers.

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4—The flushing tank and all devices are demountable so that the truck proper can be employed for other purposes at seasons when not required for flushing as in the winter, etc.

Full information supplied to interested city officials.

The Tiffin Wagon Co., Tiffin, Ohio

Mex., Chihuahua—State and municipal authorities are contemplating the repaving of the streets of the city of Chihuahua. Although no call for bids has yet been made, Consul Stewart understands that they will be requested in the near future. The present plan embraces the paving of 300,000 square meters.

Ia., Marshalltown—Now taking new bids on grading South 6th and South 12th streets. Work to be completed by July 1. Anne M. McMahon, city clerk.

Ia., Burlington — City will resurface various streets with asphalt or brick concrete or macadam. E. P. Weinstein, city clerk.

Ia., Iowa City—Petition circulated for additional paving on east end of Market street to bridge over Ralston creek. D. T. Davis, city clerk.

Ia., Des Moines—County board rejects all bids presented on the river to river project estimated at $250,000, and Carlisle project to cost the county about $[illegible]. Bids to be readvertised in 1921.

Ky., Wilmore—Paris firm $75,000 worth of road bonds is for sale in Bourbon county.

Kans., Finney Co.—E. C. Wenger is now resident engineer on Federal Aid read project No. 22, in Finney county. Headquarters at Garden City, Kan.

Ky., Louisville—The Dixie Highway, from New Albany to French Lick and West Baden Springs, is to be placed in repair by the Indiana State Highway Commission.

Mass., Boston—Commissioner of Public Works proposes making sidealks along Pleasant Street, East Cottage st. to Stoughton st. and Fargo st., also Market st. Sidewalks to be 3 to 10 inches above the gutter adjoining in width 5 to 12 ft. build of brick.

Miss., Jackson—Before the adjournment of its regular monthly session the Hinds county board of supervisors offered for sale a $200,000 block of the million dollar bond issue recently authorized for road improvement work. Included in the delegation sent by the Director of Home Affairs to demonstrate road construction in the Prefecture were the general engineer and construction manager of an American manufacturing company.

N. C., Greensboro—The majority for a 2,000,000 bond issue for good road building in Guilford county will be about 1,500, it is estimated.

N. J., Newark—State Highway Commission accepts Morris county's proposition to build a two-and-a-half mile section of road between Hanover and Troy Hills next year. The state body asked the Morris board to submit plans for the work and said the county would be reimbursed for its outlay.

Ont., Toronto—City council intends to construct asphalt pavements on Rushton road and Wychwood ave., at a total cost of $7,203, and concrete curbings on Wychwood ave.

Ont., Toronto—City council intends to construct concrete curbings on Glendale and Mount Royal Avenues at a cost of $1,941, and asphaltic concrete pavement on Glendale avenue at cost of $21,224.

Ont., Toronto—Hon. F. C. Biggs, minister of Public Works, stated that the government will place contracts for between 100,000 and 150,000 tons of stone.

Man., Siglunes R. M.—Bylaw to authorize the borrowing of 40,000 for the construction and improvement of a system of roads will be submitted to the electors on Dec. 21. Secretary-treasurer, Peder Forseng, Ashern, Man.

Ont., Simcoe—Norfolk county council passed by-laws adding several miles of road to the county's road system.

O., Canton—An application has been made to the county commissioners for a paved road from the plant of the National Fire-proofing Company to Greentown. Work to begin this spring.

Tenn., Knoxville—A Federal, state and county highway from Knoxville to the North Carolina line, by way of Sevierville, Gatlingsburg, Fighting Creek and Elkmont is being advocated in Sevier county.

Tenn., Columbia — Permanent surfacing is being put on the section of the new Jackson military highway between Ashton's mill and the Bear Creek turnpike.

Tenn., Nashville—The Weakely county, Reelfoot lake wing of the Memphis-to-Bristol highway, leaving the latter at Huntington and extending through McKenzie, Gleason, Dresden, Martin, also to Reelfoot Lake via. Union City, Troy and Hornbeak, Obion county, is already under construction.

Tenn., Gallatin—The engineering corps for the Jackson Highway completed the survey from West Moreland to Red Boiling Springs in Macon Co.

Tenn., Columbia—The county has authorized the issuance of $100,000 highway bonds.

Tex., Marshall — Election for $20,000 will be called soon in the City of Marshall to pave the court house square. Harrison county will assist in doing this work.

Tex., Austin—It is proposed that Travis county make a general county bond issue of $450,000.

Tenn., Pulaski — $350,000 bonds have been issued for the construction of new roads in Giles county.

Tex., Cass Co.—Voted a bond issue for $35,000. Including state and federal will make $185,000 for good roads building.

Tex., Bonham—Board of trade will confer with county authorities in order to repair three miles of road.

Wis., Sparta—Monroe co. Bids in Dec. 18 at County Tighway Comrs. office, for shaling roads in following towns in co.: New Lyme, LaFayette, Angelo and Tomah. Charles Milard, co. comsr.

W. Va., Charleston—The state road commission states that the good road bond issue amendment carried.

SEWERAGE & SANITATION

Minn., Red Wing—City council decides to build East 5th street sewer. City engr., William Geisheker. City clerk, S. T. Irvine. $17,298.

Minn., St. Cloud—City council petitioned for sewer and water mains on 9th ave. N. from 9th to 16th streets N. A. W. Buckman, city clerk.

Neb., Grand Island—Ordinance passed for creating Sewer Dist. No. 62 and No. 63. H. E. Clifford, city clerk.

Neb., Minatare—Council decide to form main sewer district and 8,571 of 10 to 15-in. evitr. clay sewer pipe with 2 centrifugal pumps, gas engines and electric motor. R. O. Chambers, city clerk. $40,293.

La., New Orleans—Charles J. Theard, president pro tem of the sewerage and water board, New Orleans, La., said recently that it was the intention of the board to ask the constitutional convention to allow the board to increase its water rates. If this is done, it is said that the city will be relieved of the annual approximate appropriation of $500,000, as the board would then be self-sustaining.

N. C., St. Paul's—Attention is called to the official advertisement that sealed proposals will be received by John S. Butler, clerk and treasurer, until Jan. 6, 12 m., for the purchase of $125,000 water, sewer and street improvement bonds.

N. J., Newark—Action on the proposed sewer in Frelinghuysen avenue, in Newark, N. J., which is intended to relieve the danger from floods in that section of the city, has been postponed by Director Raymond of the department of streets and public improvements as the leather manufacturers of the neighborhood informed him that the danger would not be great until after next March.

O., Brooklyn Heights—An extensive sewer construction program was adopted recently by the county commissioners to form two districts embracing the area of 27,000 acres, including Brooklyn Heights, Parma, Middleburg, Independence and Brookpark, Ohio, lying within the watersheds of Big Creek and the Cuyahoga river. Other districts are to be created as soon as these are completed. A recent preliminary survey placed the cost of the sewer and water systems of these two districts at $5,000,000, which will be divided between the county, the city and the benefited property owners.

WATER SUPPLY

Miss., Winona—$60,000 water, sewer, and light bonds, 6 per cent, ready for proposals until Jan. 4, 1921.

Minn., Sauk Center—J. F. Cooper, city clerk, informs us that no action has been taken in the matter of issuing the proposed $60,000 waterworks bond issue.

N. J., Camden—James H. Long, superintendent of the Camden, N. J., water department, is working out plans for increasing the city's pure artesian water supply, and it is expected that at least 5,000,000 additional gallons of water will be available daily if his plans are followed out. The normal consumption of Camden is 12,500,000 galons, but the actual capacity of the pumps is about 20,000,000 gallons. The city recently acquired the addition of several acres of land in the well field, and tests have shown that the new territory is productive without drawing on the present source of supply.

Ohio—The Upper Sandusky, Ohio, city council recently employed an expert engineer to oppose the raise of rates by the Upper Sandusky Water Company to determine the valuation of the cost of the plant. The officials of the company claim that this increase of rates is imperative.

BRIDGES

Minn., Duluth — City comsrs. order wooden bridge wrecked and fill constr. at 59th Avenue west, from Polk Street to Main street. J. A. Farrell, comsr. Eastimate $8,437.

Minn., Little Falls—Morrison co. Survey completed by Minnesota State Hgwy. Dept., 920 Guardian Life Bldg., St. Paul, for bridge No. 3477 in Two Rivers twp. over Spunk Brook. B. Y. McNairy, co. aud.

Minn., St. Paul—City purchasing agt., H. W. Austin, closed No. 29 on rein. con. bridge to be built at Cherokee Heights Blvd. Let to McManis & Tarnowski, 484 Endicott Bldg., St. Paul, $15,998 (lump sum). To begin constr. as soon as weather permits.

Mont., Livingston—Bids rejected; will readvertise Jan. 3, for bridge at foot of Yellowstone street. Bids closed Dec. 6. Harry M. Shelver, city clerk.

Minn., Warren—Marshall co. Survey completed by Minnesota State Highway Dept., 920 Guardian Life Bldg., St. Paul, for Bridge No. 3478 in Marsh Grove twp. A. G. Lundgren, co. aud.

N. C., Wilmington—City council authorized the issuance of $150,000 bonds for bridge at Smith's creek, and improvement of city sereets, also fire station to be erected.

Tex., Stephenville—Constr. work on steel bridges and concrete culverts is well underway on the Fort Worth, Stephenville and Brownwood public highway, and will be rushed until completed.

CONTRACTS AWARDED

STREETS AND ROADS

***Ariz., Phoenix**—Contract for the construction of 1,523 sq. yd. of Warrenite-Bitulithic pavement on 4-in. concrete and 2,426 sq. yd. of Warrenite-Bitulithic pavement on 2 1-2 in. concrete, awarded to Warren Bros., Boston, Mass.

***Ala., Birmingham**—City commissioners awarded contract to Dunn Construction Co., Birmingham, to pave section of Tenth ave., $4,115.

***Ala., Florence**—Contract awarded for construction of 1,250 sq. yd. of Warrenite-Bitulithic pavement on crushed stone foundation, to Southern Roads Co.

***Ala., Birmingham**—City commissioners awarded contract to H. M. Bowdry, Birmingham, to pave section of 28th st., $5,802.60.

***Cal., Gridley**—Contract for the construction of 5,070 sq. yd. of Warrenite-Bitulithic pavement on Portland cement foundation, awarded to Clark & Henery Construction Co., Sacramento.

***Ga., Savannah**—County commissioners awarded contract to Dixon Contracting Co., this city, to pave Port Wentworth road near Brampton bridge; concrete; $24,315.36.

***Cal., Los Angeles**—Contract for the construction of a highway from Inglewood through Hawthorne, 6 mi., awarded to Fred Hoffman, at. $225,000.

***Cal., Dixon** — Contract for the construction of 21,333 sq. yd. of Warrenite-Bitulithic pavement on 4-in. hydraulic concrete, awarded to Ransone-Randle Co.

Fla., Tallahassee — Pensacola Ship Building Co., Pesacola, Fla., submitted lowest bid to State Road Department ($57,100) for construction of bridge over Suwanee river at White Springs; steel truss; reinforced concrete abutments. Chas. A. Browne, State Highway Engr.

How many bids did you get on your last call ?

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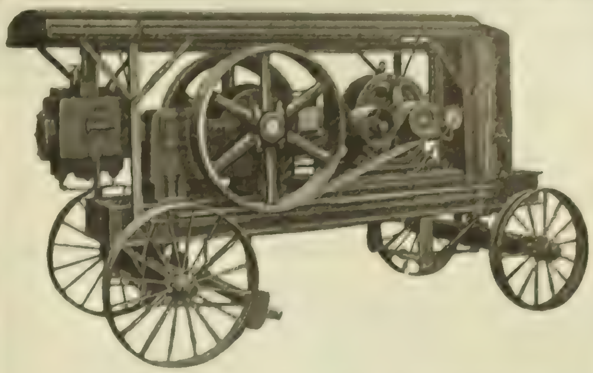

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Two 17,500 gallon tanks 7-16 in. shell, 1-2 in. heads, 60 lb. pressure.
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2 Davenport Locomotives 18 ton.
16 Western 4-yard Cars. 36 in. guage.
1 No. 1 Austin Trench Excavator
2 Potter Trench Machines.
2 miles of 45 lb. Steel Rails.
2000 Ties.
1 Koehring Paver and Conveyor.
1 Pump and Boiler.
1½ miles of 2 in. Pipe.

SHEEHAN CONSTRUCTION CO.
207 Holliday Building
INDIANAPOLIS, IND.

***Minn., Manterville** — Dodge Co. let contract building Federal Aid Project 200 (formerly 173) involving 1 acre grubbing, 26,855 cu. yd. excav., 38,518 cu. yd. overhaul, etc., Job 2002, State Rd. 6, involving 18 acres clearing and grubbing, 40,000 cu. yd. excav., etc., to Cameron, Jeyco & Co., Keokuk, Ia. About $50,000.

***Minn., Aitkin**—Aitkin Co. Contract let to O'Neil Bros. & Wilson, Cutler, Minn., for clearing of right-of-way of F. A. P. 120, State Road 1, at $2,313.75. H. E. Beecher, co. aud.

***Mich., Bessemer**—Gogebic Co. Contr. let to William Maki, same, for hauling 2,500 yds. gravel on county roads. John Luxmore, Jr., co. aud.

***Mo., Shelbyville**—Shelby Co. let contract grading and building culverts on 1.1 miles road from Hunnewell westward, 40 ft. wide to C. P. O'Reilly & Co., 624 Wainwright Bldg., St. Louis, $27,201.

***Ky., Central City** — The state road commissioners opened bids at Frankfort for the construction of the Central City and Greenville state highway, but on account of a hitch in the Federal road department's approval of the project no award of the contract has yet been announced.

***N. D., Hillsboro**—Trail Co. Contract let to W. H. Noel & Co., Jamestown, for 10 miles highway in county. Gerhard D. Olson, county aud.

***S. C., Orangeburg** Orangeburg Co. commissioners, Hugo Sims, clerk, awarded contract to J. L. Carroll, Anderson, to construct 13 miles sand-clay road on Ambrose Harwell, div. engineer, Charleston, S. C.

Tex., Daingerfield — Morris Co. let contracts grading, surfacing and draining (1) 2.66 miles Croctaw Trail, State Highway 35, 12 ft. wide, (2) 10.68 miles State Highway 1, 12 ft. wide, to C. W. Burgess, 710 Haines avenue, Dallas, (1) $36,779, (2) $93,266; both including 10 per cent for engineering and contingencies.

OFFICIAL ADVERTISING

TREASURY DEPARTMENT, Supervising Architect's Office, Washington, D.C., December 16, 1920—Sealed proposals will be opened in this office at 3 p.m., January 27, 1921, for the construction of the United States post office at Santa Fe, N. Mex. Drawings and specifications may be obtained from the custodian of the site at Santa Fe, N. Mex., or at this office, in the discretion of the Supervising Architect. Jas. A. Wetmore, Acting Supervising Architect.

BIDS WANTED FOR STREET SIGNS
The City of Wyandotte, Michigan, requests bids on 1,000 street signs for 68 different streets. Bidders may specify one or more styles of signs. The bids will be opened at 8 p.m., December 28, 1920, and should be addressed to the City Clerk. The right to reject any and all bids is reserved.
EDW. C. BRYAN,
City Clerk.

BRIDGES

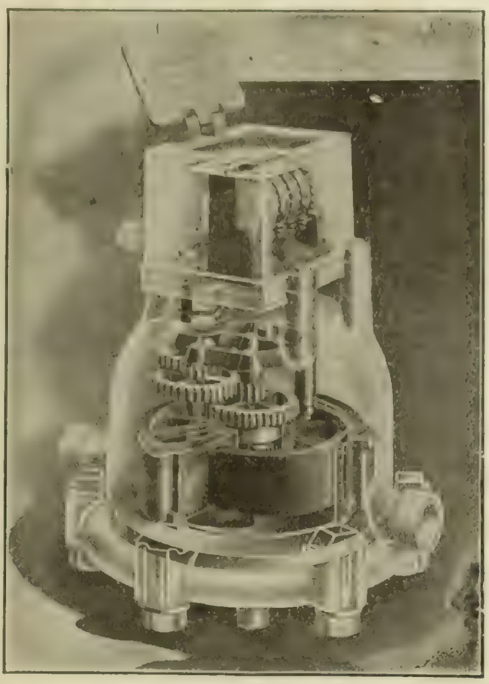
***Fla., Talahassee**—It is expected that the Pensacola Ship Building Co. will be awarded contract for Sumannee River bridge. Their bid being $57,000.

Minn., Grand Rapids—Isaca Co. Contract let to E. W. Coons Co., 230 Center sub-grade, incls. ditches, culverts and bridge No. 3445 on Job. No. 2004, State Road 9, from point 1 1-2 miles south of Grand Rapids to Intersection of town line between twp. 53, range 26, and twp. 54, range 25. Length, 7 miles. H. A. Le Sueur, highway engineer.

***Minn., Grand Rapids**—Itasco Co. Contract let to Strauss-Bascule Bridge Co., Chicago, for Bridge No. 3252 over Mississippi river, Sec. 22, Twp. 55. Closed Dec. 7.

WATER WORKS EQUIPMENT

KIND WORDS *from* GOOD FRIENDS



MEAN MUCH MORE THAN MERE PLEASANT COMPLIMENTS. THEY GIVE A LINE ON THE VALUE OF THE ARTICLE PRAISED THAT YOU CAN GET IN NO OTHER WAY AND ARE INVALUABLE TO PROSPECTIVE BUYERS

The letter from which the following quotation is taken, is from a large town in New England, and sets forth very concisely just about what is said everywhere by everybody in the water dispensing line, who has used

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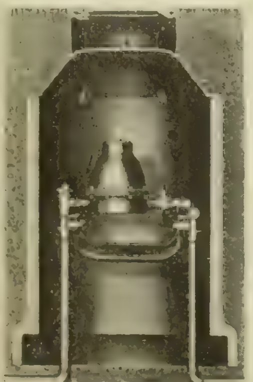

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(See Paving Machinery also)

- **Aerial Tramways**
  - Leschen & Sons Rope Co.,
- **Air Compressors**
  - Sullivan Mchy. Co.
- **Ash Handling Machinery**
  - Blaw-Knox Co.
  - Clark Tructractor Co.
- Asphalt Wagons
  - The Eagle Wagon Works
- Back Fillers (to rent)
  - Gen'l. Eng. & Const. Co.
- **Bar Benders**
  - Koehring Mch. Co.
- **Barges**
  - American Bridge Co.
- **Barrows**
- **Blasting Powder**
  - Atlas Powder Co.
  - Du Pont de Nemours Co.
  - Hercules Powder Co.
- Braces, Trench
  - The Duff Mfg. Co.
- **Bridges**
  - American Bridge Co.
  - Blaw-Knox Co.
- Bridge & Wharf Timbers (Creosoted)
  - Wyckoff Pipe&Creo.Co.,Inc.
- **Buckets, Automatic & Dumping**
  - Blaw-Knox Co.
  - Hayward Co.
  - Steubner Iron Works
- **Buckets, Clam Shell, Drag line, Orange Peel**
  - Blaw-Knox Co.
  - Brown Hoisting Mchry. Co
  - Hayward Co.
- **Bunks**
  - Southern-Rome Co.
- **Cableways**
  - Flory Mfg. Co.
  - Lidgerwood Mfg. Co.
- **Caissons**
  - Lackawanna Steel Co.
  - Underpinning & Foundation Co.
- **Cars, Dumping and Industrial**
  - W. A. Zelnicker Supply Co.
- **Carts, Concrete**
  - Acme Road Mchy. Co.
- **Castings**
  - American Bridge Co.
  - Marion Malleable Iron Works
  - U. S. Cast Iron Pipe & Foundry Co.
- Caterpiller **Tractors**
  - Holt Mfg. Co., Inc.
  - Monarch Tractor Co.
- **Chutes, Coal**
  - U. S. Cast Iron Pipe & Foundry Co.
- Conduits (Creosoted)
  - Wyckoff Pipe&Creo.Co.,Inc.
- **Cranes, Locomotive**
  - Brown Hoisting Mchry. Co
  - Orton & Steinbrenner
- **Cranes and Hoists**
  - Brown Hoisting Mchry. Co.
  - S. Flory Mfg. Co.
  - Lidgerwood Mfg. Co.
- Cross-Arms (Creosoted)
  - Wyckoff Pipe&Creo.Co.,Inc.
- Cross-Ties (Creosoted)
  - Wyckoff Pipe&Creo.Co.,Inc.
- **Crushers**
  - Acme Road Mchy. Co.
  - Universal Road Mchy. Co.
  - W. A. Zelnicker Supply Co.
- **Derricks**
  - American Bridge Co.
- **Drills**
  - Sullivan Mchy. Co.
- **Dump Wagons**
  - Austin-Western Road Mchy. Co.
  - The Eagle Wagon Works
  - Standard Steel Wks.
  - Tiffin Wagon Co.
- Dump Wagons (Gasoline propelled)
  - Clark Tructractor Co.
- **Engines**
  - Flory Mfg. Co.
  - Lidgerwood Mfg. Co.
  - W. A. Zelnicker Supply Co.
- **Excavators**
  - Austin Mchy. Corp.
  - The Baker Mfg. Co.
  - Blaw-Knox Co.
  - Hayward Co.
  - Lidgerwood Mfg. Co.
- Jacks, Lifting
  - The Duff Mfg. Co.
- **Lumber**
  - E. J. Sterner Lumber Co.
- Lumber (Creosoted)
  - Wyckoff Pipe&Creo.Co.,Inc.
- **Mixers**
  - Acme Road Mchy. Co.
  - Blaw-Knox Co.
  - Waldo Bros. & Bond Co.
  - Jaeger Mch. Co.
  - Koehring Mch. Co.
- **Motor Trucks**
  - Tiffin Wagon Co.
- **Pile Driving Machinery**
  - Flory Mfg. Co.
  - Lidgerwood Mfg. Co.
- Paint
  - Dixon Crucible Co., Jos.
- **Piles, Concrete**
  - Underpinning & Foundation Co.
- Piles (Creosoted)
  - Underpinning & Foundation Co.
  - Wyckoff Pipe&Creo.Co.,Inc.
- **Piling, Sheet Steel**
  - Lackawanna Steel Co.
  - W. A. Zelnicker Supply Co.
- **Plates, Steel**
  - Lackawanna Steel Co.
- Stand Pipes
  - Jas. McNeil & Bro. Co.
- Poles (Creosoted)
  - Wyckoff Pipe&Creo.Co.,Inc.
- **Pumps**
  - Aurora Pump & Mfg. Co.
  - Acme Road Mchy. Co.
  - Emerson Pump & Valve Co.
- **Rails**
  - Lackawanna Steel Co.
  - W. A. Zelnicker Supply Co.
- Shoes, Pipe
  - Marion Malleable Iron Works
- Snow Removal Outfits
  - The Baker Mfg. Co.
  - Holt Mfg. Co., Inc.
- **Structural Steel**
  - American Bridge Co.
  - Lackawanna Steel Co.
- **Tackle Blocks**
  - Atlantic Equipment Co.
- **Turn Buckles**
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- Tractors
  - Little Giant Co.
- **Trailers**
  - The Eagle Wagon Works
  - Highway Trailer Co.
  - Smith & Sons Mfg. Co.
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  - Gen'l. Eng. & Const. Co.
- Truck Bodies
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- **Turn Tables**
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  - Leschen & Sons Rope Co.,
- **Danger Signals**
  - Ingram-Richardson Manufacturing Co.

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  - American-La France Fire Engine Co.
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  - Loper Fire Alarm Co.
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  - Universal Road Machinery Co.
- **Concrete Mixers**
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  - Austin Mchy. Co.
  - Jaeger Mch. Co., The
  - Ransome Conc. Mchy. Co.
  - Koehring Machine Co.
  - W. A Zelnicker Supply Co
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  - Cressy Mfg. Co.
  - Good Roads Corp.
  - The Kinney Mfg. Co
  - Universal Road Mch. Co.
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  - Aurora Pump & Mfg. Co.
  - The Kinney Mfg. Co.
- **Road Graders**
  - Acme Road Mchy. Co.
  - Austin Western Rd. Mchy. Co.
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  - Russell Grader Co.
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  - Austin-Western Road Machinery Co.
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  - Holt Mfg. Co.. Inc.
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  - Austin-Western Road Machinery Co.
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  - Holt Mfg. Co., Inc.
  - Universal Road Mchy. Co.
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  - The Baker Mfg. Co.
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- **Spreaders**
  - Universal Road Mchy. Co.
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  - Connery & Co.
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  - Warren Bros. Co.
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  - Standard Steel Works
  - Truscon Steel Co.

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  - Pioneer Asphalt Co.
  - Standard Oil Co.
  - Texas Co.
  - U. S. Asphalt Refining Co.
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  - Standard Oil Co.
  - Texas Co.
  - U. S. Asphalt Refining Co
- **Bituminous Pavements**
  - Barrett Co.
  - Texas Co.
  - Warren Bros. Co.
  - Willite Road Construction Company, Inc.
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  - Alpha Portland Cement Co.
- **Creosoted Wood Block**
  - Wyckoff Pipe&Creo.Co.,Inc.
- **Expansion Joints**
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  - Truscon Steel Co.
- Oil
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  - Headley Good Roads Co.
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- **Paving Brick**
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  - Newport Culvert Co., The
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  - Champion Corp.
  - W. H. Stewart
- **Pipe Joint Compound**
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  - The Blackburn-Smith Corp.
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- **Imhoff Tank**
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- **Nozzles**
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  - Dorr Co., The
  - Sanitation Corporation
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  - W. H. Stewart
- **Screens**
  - Dorr Co., The
  - Green Bay Fdry. & Mach. Wks.
  - Pacific Flush Tank Co.
- **Flush-Tank Siphons**
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  - East Ohio Sewer Pipe Co.,
  - The Delaware Clay Products Co.
- **Vitrified Sewer Pipe**
  - The Delaware Clay Products Co.
- **Water Regulators**
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  - Tiffin Wagon Co.
- **Manholes—Catch Basins**
  - Wm. E. Dee Co.
- Garbage Wagons
  - The Eagle Wagon Works
- **Incinerators**
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  - Nye Orderless Crematory Company.
  - Stacy-Bates Co.
- **Sprinkling Wagons and Flushers**
  - Austin-Western Road Machinery Co.
  - The Kinney Mfg. Co.
- **Street Sweepers**
  - Austin-Western Road Machinery Co.
  - Elgin Sales Co.
  - Universal Road Mchy. Co.

STREET SIGNS

- Ingram-Richardson Co

WATER WORKS

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- **Air Lift Pumps**
  - Sullivan Machy. Co.
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  - Aurora Pumps & Mfg. Co.
  - Keystone Driller Co.
- **Chloride of Lime**
  - Mathieson Alkali Works
  - Penn Salt Mfg. Co.
- **Chlorine Liquid**
  - Electro Bleaching Gas Co.
  - Mathieson Alkali Works
- **Deep Well Pumps**
  - Cook, A. D.
  - Keystone Driller Co.
  - Layne & Bowler Co.
- **Disinfecting Chemicals**
  - Electro Bleaching Gas Co.
  - Mathieson Alkali Wks.
  - Penn Salt Mfg. Co.
- **Drinking Fountains**
  - Murdock Mfg. & Supply Co
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  - Pittsburgh Filter & Engineering Co.
  - Roberts Filter Co.
- **Filtration Plants**
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  - Roberts Filter Co.
  - Norwood Engineering Co
- **Filter Alum**
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- **Fire Hydrants**
  - Clark Co., H. W.
- **Flap Valves**
  - Coldwell-Wilcox Co.
- **Meters**
  - Clark Co., H. W.
  - Hersey Mfg. Co.
  - Natl. Meter Co.
  - Pittsburgh Meter Co.
  - Thomson Meter Co.
  - Union Water Meter Co
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  - Ford Meter Box Co.
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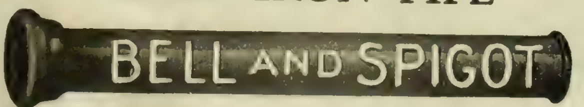

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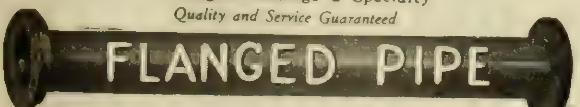

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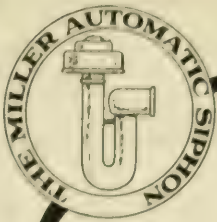

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